**3GPP TSG RAN WG1 Meeting #110bis-e R1-22xxxxx**

**e-Meeting, October 10th – 19th, 2022**

**Source: Moderator (Fujitsu)**

**Title: FL summary 1 on L1 enhancements for inter-cell beam management**

**Agenda Item: 9.12.1**

**Document for: Information**

# Introduction

This is a FL summary for A.I. 9.12.1 L1 enhancements for inter-cell beam management.

# Plan for discussion

[110bis-e-R18-Mobility-01] Email discussion on L1 enhancements for inter-cell beam management by October 19 – TBD (TBD)

* To be kicked off after first GTW session
* Check points: October 14, October 19



~~1~~~~st~~ ~~deadline: October 11, 23:59am UTC 🡪 Updated FL proposals will be provided~~

~~Intermediate deadline: October 12, 10:59am UTC 🡪 Selected proposals will be discussed in the Wed GTW session~~

* ~~GTW topic will be chosen from section 5.1.X and 5.2.X considering the maturity of the discussion~~
  + ~~High priority for proposals 1-1, 1-4, 1-5, 2-1~~
  + ~~Other proposal will be treated on a best effort basis.~~

2nd deadline: October 13, 23:59am UTC 🡪 Updated FL proposal will be provided for the 1st checkpoint (October 14th)

* High priority for proposals 2-1, 1-2 and 3-1.

FFS after the 1st checkpoint

# Contact Person

Please input the contact information for each company below:

|  |  |  |
| --- | --- | --- |
| Company | Name | Email |
| Google | Yushu Zhang | yushuzhang@google.com |
| Qualcomm | Yan Zhou | yanzhou@qti.qualcomm.com |
| Apple | Hong He | hhe5@apple.com |
| NTT DOCOMO | Jing Wang | wangj@docomolabs-beijing.com.cn |
| Lenovo | Bingchao Liu | liubc2@lenovo |
| NEC | Zhen He | he\_zhen@nec.cn |
| ZTE | Ling Yang | yang.ling17@zte.com.cn |
| Huawei, HiSilicon | Jiayin Zhang | zhangjiayin@huawei.com |
| CMCC | Jun Zuo | zuojun@chinamobile.com |
| CATT | Da Wang | wangda@catt.cn |
| Nokia | Sanjay Goyal | Sanjay.goyal@nokia.com |
| InterDigital | Paul Marinier | paul.marinier at interdigital.com |
| Futurewei | Jialin Zou | Jialinzou88@yahoo.com |
| Xiaomi | Xingyi Luo | luoxingyi@xiaomi.com |
| Spreadtrum | Huan Zhou | Huan.Zhou@unisoc.com |

# List of Contributions

|  |  |  |
| --- | --- | --- |
| [**R1-2208406**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208406.zip) | L1 enhancements for inter-cell beam management | Huawei, HiSilicon |
| [**R1-2208500**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208500.zip) | Discussion on L1 enhancements for L1/L2-based inter-cell mobility | Nokia, Nokia Shanghai Bell |
| [**R1-2208509**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208509.zip) | L1 enhancements for inter-cell beam management | ZTE |
| [**R1-2208570**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208570.zip) | Discussion on L1 enhancements for inter-cell beam management | Spreadtrum Communications |
| [**R1-2208664**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208664.zip) | Discussion on L1 enhancements for L1/L2 mobility | vivo |
| [**R1-2208679**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208679.zip) | L1 enhancements to inter-cell beam management | Ericsson |
| [**R1-2208747**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208747.zip) | L1 enhancements for inter-cell beam management | Lenovo |
| [**R1-2208805**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208805.zip) | Discussions on Inter-cell beam management enhancement | OPPO |
| [**R1-2208884**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208884.zip) | On Intercell beam management enhancement for NR mobility enhancement | Google |
| [**R1-2208905**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208905.zip) | Enhancements on inter-cell beam management for mobility | LG Electronics |
| [**R1-2208958**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208958.zip) | On L1 enhancements for inter-cell beam management | CATT |
| [**R1-2209024**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209024.zip) | Views on L1 enhancements for inter-cell beam management | Fujitsu |
| [**R1-2209073**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209073.zip) | L1 Enhancements for Inter-cell Beam Management | Intel Corporation |
| [**R1-2209203**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209203.zip) | L1 enhancements for inter-cell beam management | InterDigital, Inc. |
| [**R1-2209268**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209268.zip) | Discussion on L1 enhancements and Dynamic switch mechanism | xiaomi |
| [**R1-2209359**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209359.zip) | Discussion on L1 enhancements for inter-cell beam management | CMCC |
| [**R1-2209428**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209428.zip) | Discussion on L1 enhancements for inter-cell beam management | NEC |
| [**R1-2209498**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209498.zip) | L1 enhancements for inter-cell beam management | MediaTek Inc. |
| [**R1-2209603**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209603.zip) | On L1 enhancements for inter-cell mobility | Apple |
| [**R1-2209754**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209754.zip) | On L1 enhancements for inter-cell beam management | Samsung |
| [**R1-2209923**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209923.zip) | Discussion on L1 enhancements for inter-cell mobility | NTT DOCOMO, INC. |
| [**R1-2210008**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210008.zip) | L1 Enhancements for Inter-Cell Beam Management | Qualcomm Incorporated |

# Discussion

## L1 measurement

### [Closed] Intra-frequency L1 measurement

##### [Summary of contributions]

* Even though it is not always explicitly proposed by companies to support intra-frequency L1 measurement, it is deemed that many companies assumed that intra-frequency L1 measurement is supported for Rel-18 L1/L2 mobility.
  + Some companies clearly mentioned that Rel-17 L1 measurement (i.e. *CSI-SSB-ResourceSet*) is a starting point, which includes intra-frequency L1 measurement.
* Meanwhile, it is also mentioned that the mechanism of intra-frequency measurement is not necessarily follow Rel-17 ICBM mechanism because RAN2 has agreed that Rel-17 ICBM is not a prerequisite feature for L1/L2 mobility, i.e. commonality with inter-frequency measurement is important.
* Furthermore, potential issues below are raised to support Rel-18 L/L2 mobility scenarios, which require more discussion in RAN1. It is noted that this requires additional RAN4 work.
  + Restriction on Rel-17 L1 intra-frequency measurement is still valid or not, e.g.
    - The same SCS and *sfn-SSB-Offset* as the serving cell
    - The same center frequency as the SSB of the serving cell
    - Rx time difference, i.e. SSB from non-serving cell should be received within the CP of that for serving cell
      * This may require symbol level L1 measurement gap or SMTC for asynchronous cells
    - Measurement for overlapping SSBs

##### [FL observation]

Given the majority view, FL thinks that intra-frequency non-serving cell L1 measurement should be supported for Rel-18 L1/L2 mobility, and this can be agreed in this meeting. Meanwhile, further discussion is needed whether Rel-17 mechanism for ICBM can be reused, modification is necessary or new mechanism is more suitable to support Rel-18 scenarios. FL proposal would like to request interested companies to further study what is the best design for intra-frequency L1 measurement until the next RAN1 meeting taking into account the proposals from companies:

##### [FL proposal 1-1-v1]

* For Rel-18 L1/L2 mobility, intra-frequency non-serving cell L1 measurement is supported
  + At least the following aspects are for RAN1 further study:
    - Possibility to reuse of Rel-17 ICBM CSI measurement framework
    - Relaxation for the restrictions imposed on the Rel-17 intra-frequency L1 non-serving cell measurement, where RAN4 impact is foreseen, i.e.
      * SCS alignment with serving cell
      * Center frequency alignment and/or SFN offset compared with serving cell
      * BWP setting, i.e. non-serving cell SSB should be covered by serving cell active BWP
      * Introduction of symbol level gap or SMTC for larger Rx timing difference (i.e. larger than CP length)
    - Commonality with inter-frequency L1 measurement (if supported)
* *FL note: this issue is a high priority issue from FL point of view*

##### [Discussion on proposal 1-1-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-1-v1 | Response from FL |
| MediaTek | We support the direction of the proposal. However, we might need to first clarify the definition of “intra-frequency”. Whether we can reuse Rel-17 ICBM intra-frequency L1 measurement restriction or having some modification on top of it might need RAN2/RAN4 inputs to ensure that RAN1 discussion scenario is aligned with other working groups. Also, whether to have similar time domain restriction as specified for Rel-17 ICBM should also be discussed together with the proposal. Therefore, we suggest following update on the first sub-bullet  Possibility to reuse of Rel-17 ICBM CSI measurement framework and restriction  As for the second sub-bullet, it’s our understanding that the discussion should focus on how to relax Rel-17 ICBM restriction if reusing the same restriction and framework is not feasible. Therefore, we suggest the following update on the second sub-bullet   * + - Whether and how to apply ~~Rr~~elaxation for the restrictions imposed on the Rel-17 intra-frequency L1 non-serving cell measurement, where RAN4 impact is foreseen, i.e.   We also would like to add a bullet about sending LS to RAN2/4 on intra-frequency requirement/restriction clarification.   * + Send LS to RAN2/4 regarding intra-frequency restriction | Thanks for the suggestion. The first and second change looks good. Let’s see if other companies are OK.  For the LS to RAN4, I’m fine to do so, but not sure which aspect we should specifically ask, i.e. which part RAN1 request to relax? Let’s discuss this aspect in the 2nd round. |
| Google | Support in principle |  |
| OPPO | The revision suggested by MediaTek is good to us. It really need to first discuss whether relation is needed or possible. |  |
| QC | We have the following comments: 1) Good to change “non-serving cell” to “candidate cell”, since serving cell as candidate cell is under RAN2 discussion as in the RAN2 LS; 2) Add “for measurement configuration” to be consistent with the next proposal to be more specific.   * For Rel-18 L1/L2 mobility, intra-frequency ~~non-serving~~ candidate cell L1 measurement is supported   + At least the following aspects are for RAN1 further study:     - Possibility to reuse of Rel-17 ICBM CSI measurement framework     - Relaxation for the restrictions imposed on the Rel-17 intra-frequency L1 non-serving cell measurement, where RAN4 impact is foreseen, i.e.       * SCS alignment with serving cell       * Center frequency alignment and/or SFN offset compared with serving cell       * BWP setting, i.e. non-serving cell SSB should be covered by serving cell active BWP       * Introduction of symbol level gap or SMTC for larger Rx timing difference (i.e. larger than CP length)   Commonality with inter-frequency L1 measurement for measurement configuration (if supported) | Thanks for the proposal and careful check. Both changes look good for me. Let’s see if other companies are also OK. |
| Fujitsu | Support. From our understanding, the definition of intra-frequency will be addressed by the “relaxation” sub-sub-bullet. E.g., if relaxation for the restrictions on Rel-17 intra-frequency measurement is agreed, the definition of intra-frequency will be different from that of Rel-17 ICBM. Agree QC’s suggestion to add “for measurement configuration”. |  |
| Apple | Support.  Fine with Qualcomm modification to align the terms used in RAN2 LS. |  |
| DOCOMO | We support the revisions proposed by MTK and QC. |  |
| Lenovo | Fine with QC’s version |  |
| New H3C | Fine with QC’s modification |  |
| ZTE | We are generally fine with QC’s modification, but to further improve readability and align with other proposals’ wording, we have made the following minor updates:   * For Rel-18 L1/L2 mobility, L1 intra-frequency measurement for ~~non-serving~~ candidate cell ~~L1 measurement~~ is supported   + At least the following aspects are for RAN1 further study:     - Possibility to reuse of Rel-17 ICBM CSI measurement framework     - Relaxation for the restrictions imposed on the Rel-17 intra-frequency L1 non-serving cell measurement, where RAN4 impact is foreseen, i.e.       * SCS alignment with serving cell       * Center frequency alignment and/or SFN offset compared with serving cell       * BWP setting, i.e. non-serving cell SSB should be covered by serving cell active BWP       * Introduction of symbol level gap or SMTC for larger Rx timing difference (i.e. larger than CP length)     - Commonality with L1 inter-frequency ~~L1~~ measurement for measurement configuration (if supported) | Thanks for your careful check! |
| Huawei, HiSilicon | We need to figure out the clear definition of “intra frequency” for L1 measurement. Theoretically, there is no definition in RAN4 spec on intra/inter frequency for L1 measurement. If compared with the definition of intra frequency in L3 measurement, the requirement for ICBM is a subset of intra frequency in L3.  We think at least the requirement for Rel-17 ICBM should be one of valid scenario for L1/L2 mobility as intra frequency. Thus, we suggest to add a note under main bullet as following:  Note: At least the requirements defined in 9.13.2 in TS38.133 for Rel-17 ICBM can be regarded as intra frequency for L1 measurement.  As for the bullet of “Possibility to reuse of Rel-17 ICBM CSI measurement framework”, does it imply that it might be a new CSI measurement framework for L1/2 mobility even for a UE support ICBM capability in the ICBM scenario?  We are open to further relax the applicable requirement in ICBM for L1 intra frequency measurement. However, some candidate looks like inter frequency as compared with L3 measurement, such as SCS, center frequency.  The last bullet is not quite clear to us. We expect there is no overlapped scenario between inter and intra. Why there is commonality? | Regarding the note, it would be good to capture in the proposal for your reference. I will do so in the next revision.  Regarding your question on “Possibility to reuse of Rel-17 ICBM CSI measurement framework”, yes, that’s my understanding from my reading of proposal 1 from R1-2208679. I understand companies have their own preference, but I hope the detailed discussions can be done in November meeting.  “some candidate looks like inter frequency” Yes, I share our view. My intention is to have further discussion on which part can be relaxed for intra-freq measurement.  Regarding final comment, this is also from proposal 1 of R1-2208679. |
| LG | Fine with MediaTek’s version |  |
| CMCC | ZTE’s update is fine to us. We also agree to send LS to RAN2/4 regarding intra-frequency restriction. |  |
| CATT | Support. Fine with Qualcomm modification. |  |
| vivo | Fine with revisions proposed by MTK and QC. |  |
| Ericsson | We agree it is a good place to start, to state that intra-frequency are supported, and to investigate if there is a possibility to relax some of the restriction. These relaxations may come at the price of reduced accuracy.  As we see it, we should not change the definition of intra-frequency that RAN4 has. Allowing different SCSs or different center frequency of the SSBs is thus not relevant. We propose that RAN1 assumes that the definition of intra-frequency remains.  It is not clear to us what it means to reuse the Rel-17 ICBM framework: is it related to configuration? Is so, can we add that for clarification. We also propose to add another point for study: commonality with L3 intra-frequency measurements.  Summing up, we propose (based on QCs proposal)   * For Rel-18 L1/L2 mobility, intra-frequency ~~non-serving~~ candidate cell L1 measurement is supported   + RAN1 assumes that the definition of intra-frequency measurement from Rel-15 is kept.   + At least the following aspects are for RAN1 further study:     - Possibility to reuse of Rel-17 ICBM CSI measurement configuration framework     - Relaxation for the restrictions imposed on the Rel-17 intra-frequency L1 non-serving cell measurement, where RAN4 impact is foreseen, ,e.g.,       * SFN offset alignment compared with serving cell       * BWP setting, i.e. non-serving cell SSB should be covered by serving cell active BWP       * Introduction of symbol level gap or SMTC for larger Rx timing difference (i.e. larger than CP length)       * Commonality with intra-frequency L3 measurements   Commonality with inter-frequency L1 measurement for measurement configuration (if supported) | Fine with your proposal and I will capture it in the next update. Meanwhile, I think the bullet of your proposal on “commality with ~~” should be one-level up. Let me know if my understanding is wrong. |
| Nokia | Support with QC modifications. |  |
| InterDigital | Support. Also fine with Ericsson’s version. |  |
| Samsung | We are supportive of the direction of the proposal. Regarding relaxation of restrictions (such as SCS or centre frequency), we should first check with RAN4 as suggested by MediaTek | To give a clear request to RAN4, I think we should clarify which restriction(s) should be relaxed from RAN1 perspective. This is something we can discuss in the 2nd round. |
| Futurewei | We support intra-frequency L1 measurement for L1/L2 mobility and agree on the aspects suggested by FL for further study. |  |
| Intel | We are OK in general with the version from Ericsson. We think that Rel-17 ICBM framework may be a good starting point. For the Rel-17 ICBM framework, we think the both measurement and L1-reporting configuration should be in scope. This can be added to Ericsson’s version. |  |

##### [FL observation]

Besides the wording improvements, most of comments are related to the restriction on intra-frequency measurement. Fortunately, the proposal by companies is not exclusive and hence everything are captured eventually. Please see the updated proposal below (v2).

Also, there was a request to send an LS to RAN4 on the relaxation of the restriction for intra-frequency L1 non-serving measurement, FL thinks that which part of the restriction(s) should be relaxed from RAN1 perspective. Since this was not clarified through 1st round discussion, FL would encourage companies to provide your opinion.

Regarding the proposal by Huawei to add a note on RRM spec, the corresponding description is captured below for your reference. FL believes this is a good reference for RAN1 understanding.





##### [FL proposal 1-1-v2]

* For Rel-18 L1/L2 mobility, L1 intra-frequency measurement for ~~non-serving~~ candidate cell ~~L1 measurement~~ is supported
  + RAN1 assumes that the definition of intra-frequency measurement from Rel-15 is kept.
  + At least the following aspects are for RAN1 further study:
    - Possibility to reuse of Rel-17 ICBM CSI measurement framework [and restriction]
    - Whether and how to apply relaxation for the restrictions imposed on the Rel-17 intra-frequency L1 non-serving cell measurement defined in 9.13.2 of TS38.133, where RAN4 impact is foreseen, e.g. ~~i.e.~~
      * ~~SCS alignment with serving cell~~
      * ~~Center frequency alignment and/or~~ SFN offset alignment compared with serving cell
      * BWP setting, i.e. non-serving cell SSB should be covered by serving cell active BWP
      * Introduction of symbol level gap or SMTC for larger Rx timing difference (i.e. larger than CP length)
    - Commonality with intra-frequency L3 measurement
    - Commonality with L1 inter-frequency ~~L1~~ measurement for measurement configuration (if supported)
* Send an LS to RAN4 (CC RAN2)
  + RAN1 to ask RAN4 if the restriction on [SFN offset alignment, BWP setting and Rx timing difference] described in 9.13.2 of TS38.133 for intra-frequency L1 non-serving measurement can be relaxed or not.
* *FL note: this issue is a high priority issue from FL point of view*

##### [Discussion on proposal 1-1-v2]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-1-v2 | Response from FL |
| Xiaomi | Support |  |
| CATT | Support |  |
| vivo | Support in principle. |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

##### [Conclusion]

The following agreement was made in GTW on Oct 12. With this, the email discussion of this section is closed. The discussion on the LS is performed under 5.1.8.

Agreement

* For Rel-18 L1/L2 mobility, L1 intra-frequency measurement for candidate cell is supported
  + At least the following aspects are for RAN1 further study:
    - RAN1 assumes Rel-17 ICBM CSI measurement as starting point.
    - Whether and how to apply relaxation for the restrictions imposed on the Rel-17 intra-frequency L1 non-serving cell measurement defined in 9.13.2 of TS38.133, where RAN4 impact is foreseen, e.g.
      * SFN offset alignment compared with serving cell
      * BWP setting, i.e. non-serving cell SSB should be covered by serving cell active BWP
      * Introduction of symbol level gap or SMTC for larger Rx timing difference (i.e. larger than CP length)
    - Commonality with intra-frequency L3 measurement
    - Commonality with L1 inter-frequency measurement for measurement configuration
* Send an LS to RAN4 (CC RAN2)
  + RAN1 to ask RAN4 if the restriction on e.g., SFN offset alignment, BWP setting and Rx timing difference, etc, described in 9.13.2 of TS38.133 for intra-frequency L1 non-serving measurement can be relaxed or not.
  + RAN1 assumes Rel-17 ICBM CSI measurement as starting point.

### Inter-frequency L1 measurement

##### [Summary of contributions]

* Although the discussion on inter-frequency measurement is ongoing in RAN2, many companies showed their interest on the support of inter-frequency L1 measurement, which is required for inter-cell mobility scenario captured in the WID.
* It is also pointed out by many companies that the introduction of SMTC and measurement gap would be needed to perform inter-frequency L1 measurement.
* The definition of inter-frequency scenario is however not clear, and hence the clear distinction of intra-frequency and inter-frequency is needed, which may require RAN4’s help.
  + For example, even when the frequency of non-serving cell SSB is the same as serving cell SSB, it might be categorized as inter-frequency if the SCS not identical.
* It is proposed to use CSI-RS based measurement and reporting for inter-frequency (and this will be discussed in section 5.1.4)

##### [FL observation]

FL thinks that the scenario discussions should be done in RAN2 although spec impact should be analysed in RAN1 and RAN4. Given the situation that RAN2 discussion on inter-frequency mobility is still ongoing, RAN1 should wait for their input to avoid the duplicated discussion. Therefore, FL would propose to focus only on the potential RAN1 spec impact at this moment, and the detailed discussion can be started after receiving RAN2 LS.

##### [FL proposal 1-2-v1]

* For Rel-18 L1/L2 mobility, further study the potential RAN1 spec impact of inter-frequency L1 measurement
  + At least the following aspects are considered:
    - Introduction of measurement gap and SMTC for L1 inter-frequency measurement
    - Commonality with L1 intra-frequency measurement for measurement configuration
  + The definition of inter-frequency includes at least:
    - the frequency of the measured RS is not covered by any of the active BWPs of SpCell and Scells configured for a UE.
  + The decision on the introduction of inter-frequency L1 measurement is up to RAN2
* *FL note: this issue is a high priority issue from FL point of view, but RAN1 should wait for the decision by RAN2*

##### [Discussion on proposal 1-2-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-2-v1 | Response from FL |
| MediaTek | We agree that inter-frequency is an essential discussion aspect in Rel-18 mobility enhancement. However, as mentioned in FL note, we also prefer to wait for RAN2 discussion outcome on the inter-frequency scenario/definition. Then whether and how to introduce measurement gap can be RAN4 discussion. Note that we only have limited TU shared with 9.12.2 and overlapped discussion topics with RAN2 is not desirable. Therefore, we suggest to postpone the discussion of this proposal in this meeting and wait for RAN2 decision. | Thanks for the comments. Share the same opinion that we have only 6TUs! |
| Google | Support in principle |  |
| OPPO | We prefer to wait for the RAN2 discussion on inter-frequency scenario. The proposal has a bullet of “definition of ..”, which seems also need to wait for RAN2 discussion too. | Definition of inter-frequency would require RAN4 and RAN2 confirmation, I agree. I modify this part to clarify that “this is RAN1 understanding” |
| QC | Suggest to split the inter-frequency definition into two cases, which may have different treatment, e.g. whether measurement gap is needed. Also, prefer to carry on the high-level discuss without waiting for RAN2 LS, since inter-frequency is already supported in WID, and RAN1 has already waited for 2 meetings   * For Rel-18 L1/L2 mobility, further study the potential RAN1 spec impact of inter-frequency L1 measurement   + At least the following aspects are considered:     - Introduction of measurement gap and SMTC for L1 inter-frequency measurement     - Commonality with L1 intra-frequency measurement for measurement configuration   + The definition of inter-frequency includes at least:     - the frequency of the measured RS is not covered by any of the active BWPs of SpCell and Scells configured for a UE, but is covered by some of the configured BWPs of SpCell and Scells configured for a UE.     - the frequency of the measured RS is not covered by any of the configured BWPs of SpCell and Scells configured for a UE   + The decision on the introduction of inter-frequency L1 measurement is up to RAN2   *FL note: this issue is a high priority issue from FL point of view, ~~but RAN1 should wait for the decision by RAN2~~ and RAN1 should update the decision based on further RAN2 input* | The proposal under “definition of …” is OK for me. But Huawei’s proposal would be better for now. Let’s check companies’ view. |
| Fujitsu | Support |  |
| Apple | Measurement gap and SMTC-setting are topics handled by RAN4. Also, the inter-frequency vs. intra-frequency definition were introduced by RAN4. Not sure RAN1 needs to handle them.  In our view, RAN1 needs to first discuss and identify any related RAN1 work for inter-frequency mobility, except the RAN4-centric topics listed above. | Agree, MG and SMTC is a RAN4 issue. Regarding gap and SMTC. I can add something in the next revision to clarify this. Another approach is just to remove the corresponding bullet. I think both approach works, but former one would be better if we send an LS to RAN4 on our agreements in this meeting. |
| DOCOMO | We also prefer to have some discussion on this issue without waiting for RAN2 LS.  And we think that the cases not covered by ‘relaxation of the restrictions for intra-frequency’ (i.e., the outcome of FL proposal 1-1) can be also discussed as cases for inter-frequency. | For the second point, I agree. It can be included our LS to RAN4 (discussed in 5.1.1 and 5.1.8) , if agreed. |
| Lenovo | WID has noted that both inter-frequency and intra-frequency are supported for L1/L2 mobility, so we prefer to study the related issues without RAN2 LS.  And we agree with Apple that measurement gap and SMTC should be handled by RAN4, no need to discuss in RAN1. | Please see my comment to apple. |
| New H3C | Fine with this proposal in principal. |  |
| ZTE, Sanechips | Although the related issues are being discussed in other working groups, but in order to avoid duplicated discussion and waiting time for other WGs LS, we think that RAN1 can discuss inter-freq related issues with other WGs, such as RAN2/4 in parallel. Besides, RAN1 can send an LS to other WGs to sync or inform RAN1’s progress. | Regarding an LS to RAN2/4, I will trigger another discussion. please see section 5.1.8 |
| Huawei, HiSilicon | To our understanding, both inter frequency and intra frequency scenario are supported according to WID. We could start to work on RAN1 specific issue without waiting for RAN2.  Similar as our comment in 5.1.1, we are not quite sure the meaning of sentence “Commonality with L1 intra-frequency measurement for measurement configuration”  As for the definition of inter frequency, maybe we do not need to list here. Actually, it is up to RAN4. And usually, the supported scenario not included in intra frequency will be regarded as inter frequency. | On “commonality ~~” issue, please see my reply in 5.1.1  I see your point on the definition on inter-frequency. Please see my updated proposal. |
| LG | Fine in principle. But on the definition/scenario of inter-frequency, it would be better to wait the result of RAN2 discussion. Also, we have a similar view with Apple for measurement gap and SMTC setting. | Please find my reply to Apple. |
| CMCC | Support the proposal. According to the WID, both inter-frequency and intra-frequency are supported for L1/L2 mobility. |  |
| CATT | Since WID already includes both inter frequency and intra frequency scenario, we prefer to parallel discuss this issue with other WGs and sync with each other.  The definition of inter-frequency is RAN4 scope. We don’t need to discuss it currently. | Please find my reply to Apple. |
| vivo | Similar with intra-frequency, we think the potential RAN1 spec impact of inter-frequency L1 measurement should not be discussed until the definition of inter-frequency is determined by RAN4. Otherwise, potential spec impact cannot be analysed clearly. Therefore, we also prefer to wait for RAN4 discussion outcome on the inter-frequency definition. |  |
| Ericsson | We agree with HW that inter-frequency is part of the WID, and RAN1 could look into RAN1 aspects without waiting for RAN2 input.  Then we agree with Apple that questions related to measurements gaps should be handled by RAN4. Also, RAN1 should not re-define what inter-frequency means.  To us, the RAN1 impact is limited to the configuration framework, which could (should) be aligned with the intra-frequency framework. | Please find my reply to Apple. |
| Nokia | Agree with Ericsson’s view |  |
| InterDigital | Support FL proposal (except the FL note – agree with other companies that RAN1 does not need to wait). Also fine with Qualcomm revisions. |  |
| Samsung | Inter-frequency should be considered for L1/L2 mobility. However, we should avoid duplicating discussions that take place in other WGs (RAN2/RAN4). We are fine to start discussing RAN1 aspects that don’t depend on other WGs. |  |
| Futurewei | Since in feMob WID inter-frequency is a scenario to be support in L1/L2 mobility, we support RAN1 further study the inter-frequency L1 measurement. We are fine with the aspects suggested by FL except the last item requesting RAN2 to make the decision on whether to introduce inter-frequency L1 measurement. We are not sure if RAN2 is able to make the decision.  In fact, the WID rapporteur (MediaTek) in their RAN2 contribution suggests: “For inter-frequency mobility, ask RAN1/RAN4 to evaluate the feasibility and complexity if L1 measurement and report are intended to be supported for inter-frequency mobility for different scenarios.”  Suggest RAN1 performs the feasibility study of inter-frequency L1 measurement without waiting for RAN2, and sends LS to RAN4 to get their input. | I also notice MTK proposal in RAN2, and this is the reason why RAN1 and RAN2 have a duplicated discussion. We should keep in mind that RAN2 is a leading WG on this WI.  I’ m not sure what is the intention to send an LS to RAN4. Maybe the question should be clear. If the intention is just to inform RAN1 agreements, that’s OK and it can be discussed in the separate section (5.1.8) |
| Intel | Agree with Ericsson and Apple.  Issues related to measurement gaps and definition of inter-frequency should be left up to RAN4.  Not sure what “commonality with L1-intra-frequency measurement for measurement configuration” exactly means. If the aim is to align configuration with the intra-frequency case from RAN1 perspective, it should be stated as such. | Please find my reply to Apple.  Regarding “commonality”, I’m not sure what is the difference between the original text and your suggestion. (RAN1 perspective is always the case because this is RAN1 discussion). Hope you can give me an exact wording in the 2nd round discussion. |

##### [FL observation]

We confirm the split view on the necessity of RAN2 LS on the RAN1 work for inter-frequency measurement – companies views are equally split.

* Wait for RAN2/4 discussion (9)
  + MTK, Google (support FL), OPPO, Fujitsu (support FL), New H3C(Support FL) , LG, CMCC(Support FL), vivo, Samsung,
* Proceed RAN1 discussion without RAN2 LS (11)
  + QC, DOCOMO, Lenovo, ZTE, Huawei, CATT, Ericsson, Nokia, InterDigital, Futurewei, Intel

Given this situation, FL would like to suggest to continue RAN1 discussion on the inter-frequency measurement by looking at potential RAN1 spec impact, but give (slightly) low priority until RAN2 finishes their discussion.

As for other comments by companies, FL believes that their concerns have been addressed in FL proposal 1-2-v2 below. The necessity of LS is discussed under 5.1.8.

##### [FL proposal 1-2-v2]

* For Rel-18 L1/L2 mobility, further study the potential RAN1 spec impact of inter-frequency L1 measurement
  + At least the following aspects are considered:
    - Introduction of measurement gap and SMTC for L1 inter-frequency measurement, which is expected to be a RAN4 issue
    - Commonality with L1 intra-frequency measurement for measurement configuration
  + RAN1 assumes that the supported scenario not included in intra-frequency will be regarded as inter-frequency
  + ~~The definition of inter-frequency includes at least:~~
    - ~~the frequency of the measured RS is not covered by any of the active BWPs of SpCell and Scells configured for a UE, but is covered by some of the configured BWPs of SpCell and Scells configured for a UE.~~
    - ~~the frequency of the measured RS is not covered by any of the configured BWPs of SpCell and Scells configured for a UE~~
  + The decision on the introduction of inter-frequency L1 measurement is up to RAN2, and hence RAN1 discussion shall focus on RAN1 relevant issues.
* Send an LS to RAN4 (CC RAN2)
  + RAN1 would like to confirm our understanding that the supported scenario not included in intra-frequency L1 non-serving measurement will be regarded as inter-frequency, if inter-frequency L1 candidate cell measurement is introduced for Rel-18 L1/L2 mobility.
  + Note: this content is included in the LS discussed in proposal 1-1
* *FL note: this issue is a high priority issue from FL point of view, but give a slightly lower priority until receiving RAN2 LS. ~~but RAN1 should wait for the decision by RAN2~~*

##### [Discussion on proposal 1-2-v2]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-2-v2 | Response from FL |
| Xiaomi | We prefer to remove SMTC which has nothing to do with inter-frequency measurement. From our understanding, it is just one feature of SSB. What really matters is the measurement gap, as shown in figure below, may need to be introduced in beam measurement framework to deal with the inter-frequency L1 measurement.     * + At least the following aspects are considered:     - Introduction of measurement gap ~~and SMTC~~ for L1 inter-frequency measurement, which is expected to be a RAN4 issue | SMTC issue was discussed in the Wed GTW, and similar sentence has been agreed. Hope you are OK to keep it now. |
| vivo | Support in principle. And the final definition of L1 intra-frequency measurement and L1 inter-frequency measurement is determined by RAN4. | Yes, the definition of L1 inter-freq meas. will be defined in RAN4. The sentence in this proposal is to avoid the discussion on such as “what is inter-freq?” I will add a sentence such as “the final definition is determined by RAN4” |
| Fujitsu | Support. Similar with the intra-frequency case, RAN1 can proceed with its own assumption and the definition is up to RAN4. |  |
| ZTE | According to the following latest conclusion from RAN2, we understand that inter-frequency scenario has been supported for L1/L2 mobility in RAN2. So, we propose that we can directly discuss or determine whether inter-frequency measurement is supported in RAN1, but we still think that definition of inter-frequency measurement should be decided by RAN4.   * Inter-freq L1L2 mobility: R2 Confirms that For L1L2 mobility inter-freq scenarios in general should be supported (including mobility to inter-frequency cell that is not a current serving cell), including the support of inter-frequency L1 measurements, if feasible by R4 and R1. | Thanks for the information.  We can add some positive sentence to move forward on L1 inter-frequency measurement but RAN4 confirmation is necessary. |
| New H3C | OK in principal |  |
| LG | Fine with the proposal and similar view with ZTE |  |
| Spreadtrum | We support the proposal.  Thanks to ZTE’s information. Since RAN2 has confirm inter-frequency is in the scope, RAN1 can start to study the aspects related with inter-frequency ICBM. |  |
| CATT | According to the RAN2 latest agreement, inter-frequency scenario for L1/L2 mobility has been supported from RAN2 point of view. Thus, the sub-bullet “The decision on the introduction of inter-frequency L1 measurement is up to RAN2, and hence RAN1 discussion shall focus on RAN1 relevant issues.” can be deleted. We think based on RAN2’s decision, inter frequency scenario is also supported in RAN1.  Moreover, we have confusion on the sub-bullet “RAN1 assumes that the supported scenario not included in intra-frequency will be regarded as inter-frequency”. Why do we add this bullet in the proposal? We think Huawei’s intention is just to explain the definition of inter frequency is up to RAN4. We think the scenarios of intra-frequency and inter-frequency is also up to RAN4, not RAN1 issue. Thus, in LS, we can ask RAN4 the detail definitions and scenarios of intra-frequency and inter-frequency. | For 1st bullet, yes, that’s reasonable proposal.  As for the assumption on RAN1 assumption on inter-freq meas. please see my comment to vivo. |
| CMCC | We also suggest to remove “RAN1 assumes that the supported scenario not included in intra-frequency will be regarded as inter-frequency”. We think RAN4 would clearly define intra-frequency L1 measurement and inter-frequency L1 measurement. | please see my comment to vivo. |
| Huawei, Hisilicon | Response to CATT, the reason I raised the definition of inter frequency is that the original text (the 3rd sub bullet slashed) may not cover all scenarios for inter frequency. The current sentence is trying to define the inter frequency similar as that in L3. Without such assumption, the proposal might be challenged that we propose to study a scenario we are not sure what is it, as the commented for intra frequency in GTW.  We share the similar view as CATT to delete the sentence of “The decision on the introduction of inter-frequency L1 measurement is up to RAN2, and hence RAN1 discussion shall focus on RAN1 relevant issues.” considering the progress in RAN2.  Another issue is from our side is whether this proposal is applied for SSB-based L1 measurement or it may also applies to CSI-RS based L1 measurement if supported? | I share similar view as Huawei. if we use the terminology “inter freq meas” the definition is necessary to avoid our misunderstanding, even though this definition may not be same as RAN4 (and this is the intention to send LS to RAN4). If we are wrong, we can correct it later.  for the second comment, I agree.  For the 3rd comment, I think it’s clear. If inter-frequency measurement is supported, it is supported. |
|  |  |  |
|  |  |  |

### [Closed] Support of L3 measurement

##### [Summary of contributions]

* It is proposed by one company to reuse L3 measurement mechanism for neighbour cell detection in L1/L2 based mobility.

##### [FL observation]

This issue has been discussed in RAN2 and captured as FFS in their minute. Duplicated discussion among WGs should be avoided.

##### [FL proposal 1-3-v1]

* RAN1 will not discuss the necessity of L3 measurement for L1/L2 mobility unless explicit request from RAN2 is received.
* *FL note: It is not intended that this proposal is captured in Chair’s note.*
* *FL note: this issue is a low priority issue from FL point of view.*

##### [Discussion on proposal 1-3-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-3-v1 | Response from FL |
| MediaTek | We agree with FL’s assessment that the debating between L3 and L1 measurement for Rel-18 cell switching mechanism has been discussed in RAN2 and we should wait for RAN2’s discussion outcome and postpone the discussion in this meeting. |  |
| Google | Support |  |
| OPPO | This can be a conclusion. |  |
| QC | Agree with FL. RAN2 LS already indicated that L1/L2 mobility is triggered by L1 measurement. Also, this agenda only handles L1 enhancement |  |
| Fujitsu | Support |  |
| Apple | Agree with FL assessment. |  |
| DOCOMO | Agree with FL. |  |
| Lenovo | Agree with FL. |  |
| New H3C | Agree with FL proposal |  |
| ZTE | Agree with FL’s proposal, but I would like to confirm whether we can further discuss or clarify the relationship between L1 measurement and L3 measurement to align understanding each other. |  |
| Huawei, HiSilicon | In response to QC, L3 measurement is used to have a rough selection of candidate cell on which L1 measurement is going to perform, considering the reporting overhead and resource for measurement. The cell switching is still be on L1 signalling. Whether this rough selection based on L3 measurement will impact L1 design, such as maximum number of candidate cell for L1 measurement.  As mentioned by FL, we can wait for RAN2 decision if there is ongoing discussion there. | Thanks, I would recommend to work with your RAN2 colleagues on this matter ! |
| LG | Agree with FL’s assessment |  |
| CMCC | Support the proposal. |  |
| CATT | Agree with FL’s assessment |  |
| vivo | Agree with FL. |  |
| Ericsson | Agree with FL’s assessment |  |
| Nokia | Agree with FL’s assessment |  |
| InterDigital | Agree with FL’s assessment |  |
| Samsung | Agree that L3 measurement should not be considered by RAN1 for L1/L2 mobility. |  |
| Futurewei | We agree the L3 measurement/report should be left to RAN2. |  |
| Intel | Agree with FL |  |

##### [Conclusion]

It is confirmed that FL proposal 1-3-v1 is a common understanding among companies (including the proponent) . With this, FL would like to close the discussion. It is not necessary to capture FL proposal 1-3-v1 in the Chair’s note.

### [Closed] Measurement RS

##### [Summary of contributions]

* It seems that most of the companies (all the companies?) think SSB should be used for L1 measurement for Rel-18 L1/L2 mobility.
* In addition, many companies have a view that CSI-RS based non-serving cell L1 measurement should be supported to enables larger bandwidth with short period, or to obtaining new refined beams for latency reduction.
  + This is to introduce explicit configuration for neighbour cell measurement, i.e. proponent companies do not want to mimic as if non-serving cell RS comes from the serving cell.
  + Also, it is also proposed to use CSI-RS for tracking, CSI-RS for beam management QCLed with SSB associated with non-serving cell for non-serving cell L1 measurement.

##### [FL observation]

While SSB can be a baseline for non-serving cell L1 measurement, use of CSI-RS for non-serving cell L1 measurement can be further discussed in RAN1 given the companies’ interest and potential benefits. The potential discussion includes the necessity itself, and how the configuration is performed. It is noted that the introduction of CSI-RS L1 measurement requires RAN4 to specify it’s requirements.

##### [FL proposal 1-4-v1]

* For Rel-18 L1/L2 mobility, SSB is supported for intra-frequency L1 measurement
* Further study the following for non-serving cell L1 measurement RS
  + SSB for inter-frequency (if supported)
  + CSI-RS associated with non-serving cell PCI, i.e. *additionalPCI*, for intra-frequency and inter-frequency (if supported)
* *FL note: this issue is a high priority issue (at least for SSB) from FL point of view. On the other hand, the use of CSI-RS looks an optional feature and an optimization, and FL doesn’t recommend spending much time.*

##### [Discussion on proposal 1-4-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-4-v1 | Response from FL |
| MediaTek | We support the proposal in general. However, as mentioned in our comment in Proposal 1-1, the definition of intra-frequency should be clarified first. We also see the benefit of measuring CSI-RS associated with non-serving, e.g., flexibility of configuration, early beam refinement possibility, and it should be further studied as stated in the proposal. | Please see FL proposal 1-1-v2. I think the updated proposal addresses your concern. |
| Google | We suggest clarifying the type of CSI-RS, is it CSI-RS for BM? | Some companies mentioned about the type in their contribution, but not many. My understanding is that CSI-RS for BM, TRS, Mobility and CSI are proposed in this meeting. I can capture them in the next revision based on companies’ request |
| OPPO | Ok in principle |  |
| QC | Suggest to replace “non-serving cell” with “candidate cell”, since serving cell as candidate cell is still under RAN2 discussion as in the LS. Also, suggest to remove “additionalPCI”, which is the configuration name in R17 and may not be reused in R18   * For Rel-18 L1/L2 mobility, SSB is supported for intra-frequency L1 measurement * Further study the following for ~~non-serving~~ candidate cell L1 measurement RS   + SSB for inter-frequency (if supported)   CSI-RS associated with ~~non-serving~~ candidate cell PCI, ~~i.e.~~ *~~additionalPCI~~*~~,~~ for intra-frequency and inter-frequency (if supported) | Thanks for the suggestion, which looks OK for me. |
| Fujitsu | Support |  |
| Apple | Support. Fine with modification from QCM. |  |
| DOCOMO | Support in principle.  We also prefer to clarify the possible type of CSI-RS in last bullet. | Please see my reply to Google. |
| Lenovo | Fine with QC’s version. |  |
| New H3C | Support |  |
| NEC | Support |  |
| ZTE | We have similar view with other companies and support QC’s modification with minor update, as follows:   * For Rel-18 L1/L2 mobility, SSB is supported for L1 intra-frequency ~~L1~~ measurement * Further study the following L1 measurement RS for ~~non-serving~~ candidate cell ~~L1 measurement RS~~   + SSB for inter-frequency (if supported)   + CSI-RS for tracking   + CSI-RS for beam management     - CSI-RS associated with ~~non-serving~~ candidate cell PCI, ~~i.e.~~ *~~additionalPCI~~*~~,~~ for intra-frequency and inter-frequency (if supported) | Fine to include CSI-RS for tracking in the next revision |
| Huawei, HiSilicon | Support the proposal and fine with QC’s revision |  |
| LG | Fine with the Qualcomm’s modification. |  |
| CMCC | Support the proposal. |  |
| CATT | Support the proposal with ZTE’s update. |  |
| vivo | Support. |  |
| Ericsson | In our view, there is no need to study if SSB is a supported measurement RS for inter-frequency measurement if inter-frequency is supported (which it is, in our understanding). Based on this, we propose the following update based on QC’s version:   * For Rel-18 L1/L2 mobility, SSB is supported for intra-frequency L1 measurement * For Rel-18 L1/L2 mobility, SSB is supported for inter-frequency L1 measurement, if inter-frequency L1 measurements are supported * Further study the following for ~~non-serving~~ candidate cell L1 measurement RS   CSI-RS associated with ~~non-serving~~ candidate cell PCI, ~~i.e.~~ *~~additionalPCI~~*~~,~~ for intra-frequency and inter-frequency (if supported) | I will update the proposal, accordingly |
| Nokia | In general, we agree to support CSI-RS measurements for L1/L2 mobility. Note that the Rel-17 can allow CSI-RS measurements with different PCIs via indirect QCL chain (e.g., using SSB as the QCL reference), hence there is no limitation from the RAN1 perspective. Therefore, if we agree to reuse Rel-17 based L1 measurement configuration (for both SSB and CSI-RS), then the proposal on supporting CSI-RS should clearly specify what additional support needs be studied further. If it’s related to inter-frequency, then it is applicable to both types of RSs (SSB and CSI-RS).  In terms of wording, we agree with QC proposal. Additionally, it will be more clear if we use “SSB associated with candidate cells” instead of “SSB”. | For your first view, I think your proposal has already included in FL proposal. Let me know if further clarification is necessary.  For the second proposal on “SSB associated …” I’m not sure if other companies are OK because there is a proposal not to give PCI (just indicate frequency only) in this meeting. I can capture it for now, but let’s see other companies’ view in the second round. |
| InterDigital | Fine with Ericsson’s version. |  |
| Samsung | OK in principle. |  |
| Futurewei | Support FL’s proposal. Fine with the Qualcomm’s modification. |  |
| Intel | Agree with Nokia that “SSB associated with non-serving cell PCID” as used in Rel-17 ICBM would make the proposal clearer. Ok with update from Ericsson.  For CSI-RS, we think CSI-RS for BM should be supported. In Rel-17 CSI-RS is supported with SSB as indirect QCL reference. For Rel-18 mobility we think CSI-RS as direct QCL can be discussed. | See my reply to Nokia. |

##### [FL observation]

FL believes that proposals from companies are address in FL proposal 1-4-v2 below. However, it is not clear for FL if everyone is fine with the revisions especially “SSB associated with candidate cells” because it may imply SSB always needs to be associated with candidate cell(s), i.e. SSB can be found with blind detection while CSI-RS needs assistant information. Let’s discuss in the 2nd round.

##### [FL proposal 1-4-v2]

* For Rel-18 L1/L2 mobility,
  + SSB [associated with candidate cells] is supported for L1 intra-frequency ~~L1~~ measurement
  + SSB [associated with candidate cells] is supported for L1 inter-frequency measurement if inter-frequency L1 measurements are supported
* Further study the following ~~for non-serving cell~~ L1 measurement RS for candidate cell
  + CSI-RS for tracking
  + CSI-RS for beam management, which is associated with ~~non-serving~~ candidate cell PCI~~, i.e.~~ *~~additionalPCI~~*~~,~~ for intra-frequency and inter-frequency (if supported)
* *FL note: this issue is a high priority issue (at least for SSB) from FL point of view. On the other hand, the use of CSI-RS looks an optional feature and an optimization, and FL doesn’t recommend spending much time.*

##### [Discussion on proposal 1-4-v2]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-4-v2 | Response from FL |
| Xiaomi | We prefer that the CSI-RS for beam management can be configured as measurement RS of candidate cells at least when there are relatively less candidate cells.  CSI-RS can provide high performance beam of target cell. While, the time overhead of L1 measurement will increase especially when there are a lots of candidate cells. Therefore, at least when there are relatively less candidate cells, the CSI-RS for beam management can be configured as measurement RS. |  |
| CATT | For the CSI-RS, we think the CSI-RS for mobility and CSI-RS for CSI can also be further studied, which can be listed in the proposal.  For the part after CSI-RS for beam management, i.e., “which is associated with ~~non-serving~~ candidate cell PCI~~, i.e.~~ *~~additionalPCI~~*~~,~~ for intra-frequency and inter-frequency (if supported)”, which is common for all types of CSI-RS. Thus, we suggest to move this part to the main bullet. |  |
| vivo | Besides above RSs, we think CSI-RS for CSI acquisition also should be considered. [FL proposal 1-4-v2]  * For Rel-18 L1/L2 mobility,   + SSB [associated with candidate cells] is supported for L1 intra-frequency ~~L1~~ measurement   + SSB [associated with candidate cells] is supported for L1 inter-frequency measurement if inter-frequency L1 measurements are supported * Further study the following ~~for non-serving cell~~ L1 measurement RS for candidate cell, which is associated with candidate cell PCI for intra-frequency and inter-frequency (if supported)   + CSI-RS for tracking   + CSI-RS for CSI acquisition   + CSI-RS for beam management   *FL note: this issue is a high priority issue (at least for SSB) from FL point of view. On the other hand, the use of CSI-RS looks an optional feature and an optimization, and FL doesn’t recommend spending much time.* |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

##### [Conclusion]

The following agreement was made in GTW on Oct 12. With this, the email discussion of this section is closed.

Agreement

* For Rel-18 L1/L2 mobility,
  + SSB is supported for L1 intra-frequency measurement
  + SSB is supported for L1 inter-frequency measurement if inter-frequency L1 measurements are supported
* Further study the following L1 measurement RS for candidate cell
  + CSI-RS for tracking, beam management, CSI and mobility, CSI-IM, which is for L1 intra-frequency and L1 inter-frequency (if supported)

### [Closed] Measurement quantity

##### [Summary of contributions]

* It seems that most of the companies (all the companies?) think L1-RSRP should be used for Rel-18 L1/L2 mobility.
* L1-SINR is also proposed to measure interference situation and more flexible target cell selection.
* Furthermore, use of UL measurement is proposed to avoid delay and computation complexity at a UE.

##### [FL observation]

Along with the majority companies view, L1-RSRP should be used for L1 measurement for Rel-18 L1/L2 mobility. In addition, introduction of L1-SINR for non-serving cell measurement need further discussion because only a limited number of companies mentioned about the necessity in their contribuions. In addition, UL measurement may be useful for Rel-18 L1/L2 mobility, even though the details are not clear at this moment. Companies are encouraged to further study the benefit, drawback and RAN1 spec impact.

##### [FL proposal 1-5-v1]

* For non-serving cell measurement for Rel-18 L1/L2 mobility,
  + L1-RSRP is supported for intra-frequency non-serving cell measurement.
  + Further study the following measurement quantities for non-serving cell measurement
    - L1-RSRP for inter-frequency (if supported)
    - L1-SINR for intra-frequency and inter-frequency (if supported)
    - UL measurement for intra-frequency (and inter-frequency, feasibility should be further assessed)
* *FL note: this issue is a high priority issue (at least for RSRP) from FL point of view. Not sure of other quantity, thus companies’ input is appreciated.*

##### [Discussion on proposal 1-5-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-5-v1 | Response from FL |
| MediaTek | We are generally fine with the proposal based on the assumption that we should first clarify the definition of intra-frequency. On the other hand, the design of UL measurement is not clear in the proposal and we are not sure it is desirable to include this bullet in the proposal. Therefore, we suggest proponent can elaborate the details a little more and have a separate discussion on UL measurement. | Regarding the UL measurement, Please see the input from vivo. |
| Google | Support |  |
| OPPO |  |  |
| QC | Name change as previous comments. Fine to study all options at this stage   * For ~~non-serving~~ candidate cell measurement for Rel-18 L1/L2 mobility,   + L1-RSRP is supported for intra-frequency ~~non-serving~~ candidate cell measurement.   + Further study the following measurement quantities for ~~non-serving~~ candidate cell measurement     - L1-RSRP for inter-frequency (if supported)     - L1-SINR for intra-frequency and inter-frequency (if supported)   UL measurement for intra-frequency (and inter-frequency, feasibility should be further assessed) | Thanks again for your careful review and suggestion!  Regarding the UL measurement, Please see the input from vivo. |
| Fujitsu | Support |  |
| Apple | Support. |  |
| DOCOMO | Generally okay.  But we also think the UL measurement part is unclear. | Please see the input from vivo. |
| Lenovo | Fine with QC’s version.  UL measurement is not clear to us. | Please see the input from vivo. |
| New H3C | Support |  |
| ZTE | We are okay with QC’s modification and have the same issue raised by DOCOMO and Lenovo. | Please see the input from vivo. |
| Huawei, HiSilicon | Fine with the proposal except for the UL measurement part, which need to further clarify in detail. | Please see the input from vivo. |
| LG | Support |  |
| CMCC | The motivation of UL measurement is not clear to us. | Please see the input from vivo. |
| CATT | Fine with QC’s update, except for UL measurement part. We also think it is unclear. | Please see the input from vivo. |
| vivo | The motivation of UL measurement is to reduce measurement delay and UE computation complexity. Compared to measurement on SSBs from multiple candidate cells, UE only needs to transmit UL signals, e.g., SRS, and candidate cells monitor the UL signals according to the configuration of UL signals forwarded from the serving cell. Based on measurement value from different candidate cells, and the source cell could make the handover decision. In a nutshell, UL measurement achieve the same functionality as the DL measurement, and it just reverses the roles of the gNB and the UE.  We are fine to discuss UL measurement in this issue. But if some companies think it is not suitable, we suggest to discussing in issue 1-4. | I can capture this comment in the next version of FL proposal. Please check if it is OK for you and everone. |
| Ericsson | Agree with DOCOMO, Lenovo, HW, CMCC and CATT – we do not see there is any RAN1 impact of UL measurements.  The other parts are fine. | Please see the input from vivo. |
| Nokia | Agree to study first two options. However, L1-SINR will require additional support in terms of RS configuration across the cells, hence this can be studied later once the basic framework is in place supporting L1-RSRP.  UL measurement is not a measurement quantity, instead e.g., SRS-RSRP, etc. should be mentioned. In general, we do not support to include this at this stage. We should first focus on DL measurements based handover, and UL measurements based handover framework can be FFS if time allows.  Fine with QC’s changes for the terminology. | I will add your concern on L1-SINR in the next revision.  For UL measurement, it would also possibility to move this discussion to 5.1.4, but people may be confused if we do so now. Let’s keep our discussion under 5.1.5. for now.  Again, I have no plan to drop any proposal from Rel-18 at the very 1st meeting. Instead, I can add weaker sentence for UL measurement given the concern from companies. |
| InterDigital | Agree with other companies that UL measurement part could be de-prioritized. Also fine with Qualcomm terminology. |  |
| Samsung | Support measurement based on L1-RSRP for inter-cell and intra-cell scenarios. Without filtering, the L1-SINR measurement can be noisy (interference can change from one measurement instance to the next).  Not clear on the benefit of UL measurement. | Please see the input from vivo. |
| Futurewei | Support FL’s proposal. |  |
| Intel | Ok with the proposal, except the part about UL measurement which is not clear in current form. | Please see the input from vivo. |

##### [FL observation]

The most controversial part in this section is UL measurement, more specifically:

* It is mentioned that UL measurement is not clear, and the details should be captured
* It is mentioned that this is actually a proposal to introduce SRS-RSRP and should be discussed in 5.1.4
* Explanation is provided by one company

FL view is to ask interested companies to perform more detailed analysis. RAN1 can commence the discussion based on the contributions in future meetings.

Other comments from companies are address in the revision below.

##### [FL proposal 1-5-v2]

* For ~~non-serving~~ candidate cell measurement for Rel-18 L1/L2 mobility,
  + L1-RSRP is supported for intra-frequency ~~non-serving~~ candidate cell measurement.
  + Further study the following measurement quantities for ~~non-serving~~ candidate cell measurement
    - L1-RSRP for inter-frequency (if supported)
    - L1-SINR for intra-frequency and inter-frequency (if supported)
      * Note: lower priority than L1-RSRP
* Interested companies are encouraged to assess the use case and the benefit of UL measurement instead of/in addition to DL L1 measurement, which includes:
  + How the UL measurement result is used, e.g. handover decision
  + Signals/channels used for UL measurement, e.g. SRS
  + Spec impact including other WGs, e.g. definition of gNB measurement, interface to transfer RS configuration or measurement results
  + Note: The next discussion will take place based on companies’ contribution in future meeting.
* ~~UL measurement for intra-frequency (and inter-frequency, feasibility should be further assessed)~~
* *FL note: this issue is a high priority issue (at least for RSRP) from FL point of view. Not sure of other quantity, thus companies’ input is appreciated.*

##### [Discussion on proposal 1-5-v2]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-5-v2 | Response from FL |
| Xiaomi | Fine with FL proposal 1-5-v2.  The UL L1 measurement based on SRS might be a way to get the beam measurement results of candidate cells. Serving cell can send the SRS configuration to candidate cells, and candidate cells can perform L1 measurement based on SRS and send the measurement results to serving cell, which seems a feasible solution. While, we do not get the specification impact. Can this be supported just by gNB implementation? Anyway, we are OK to further discuss on UL measurement to see if it is a good solution. |  |
| CATT | Fine with the first part.  For the second part, i.e., UL measurement, we also think there is no spec impact. We prefer to first study the DL measurement, which is important for this WID. Then if the time is allow, we can further study the potential UL measurement. |  |
| vivo | Support updated FL’s proposal. |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

##### [Conclusion]

The following agreement was made in GTW on Oct 12. With this, the email discussion of this section is closed.

Agreement

* For candidate cell measurement for Rel-18 L1/L2 mobility,
  + L1-RSRP is supported for intra-frequency candidate cell measurement.
  + Further study the following measurement quantities for candidate cell measurement
    - L1-RSRP for inter-frequency (if supported)
    - L1-SINR for intra-frequency and inter-frequency (if supported)
* FFS: to assess the use case and the benefit of UL measurement instead of/in addition to DL L1 measurement, which includes:
  + How the UL measurement result is used, e.g. handover decision
  + Signals/channels used for UL measurement, e.g. SRS
  + Spec impact including other WGs, e.g. definition of gNB measurement, interface to transfer RS configuration or measurement results
  + Note: The next discussion will take place based on companies’ contribution in future meeting.

### Filtering for L1 measurement results

##### [Summary of contributions]

* Many companies see the necessity of filtering for mobility robustness, i.e. avoiding ping-pong, avoiding large amount of measurement results for gNB, or relaxing the negative impact by UE rotation.
* Two types of filtering are proposed at this meeting:
  + L3 filtering (in time domain):
  + cell-level filtering (in spatial domain), which includes the averaging of best X beams in a cell

##### [FL observation]

While the interest by many companies on filtering, the importance of “ping-pong avoidance” has not been confirmed in RAN2. Hence, the decision on ping-pong should be concluded in RAN2 first, and then RAN1 can decide which way to go. FL recommendation is to wait for RAN2 LS and then to make RAN1 decision whether or not filtering is applied to L1 measurement results. Until then, RAN1 can discuss the potential definition of filtering and applicability of L1 measurement quantities.

##### [FL proposal 1-6-v1]

* For Rel-18 L1/L2 mobility, further study the necessity of filtering to L1 measurement results considering at least the following aspects:
  + Exact definition of filtering
    - L3 filtering (in time domain): e.g. exact definition of time domain filtering
    - Cell-level measurement (in spatial domain): e.g. how many beams are averaged, and/or how the beams are chosen.
  + Importance to avoid ping-pong handover for L1/L2 mobility
    - Alignment with RAN2 is expected
  + Impact of UE rotation
  + Applicability to L1-RSRP and L1-SINR (if supported)
  + Applicability to intra-frequency and inter-frequency (if supported)
* *FL note: this issue is a medium priority issue, the system will work without this functionality even though it is not optimum. Thus FL recommends not to spending much time on this issue and make our decision at an early stage of Rel-18.*

##### [Discussion on proposal 1-6-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-6-v1 | Response from FL |
| MediaTek | We agree with FL’s assessment that RAN1 should have an aligned view with RAN2 on the ping-pong issue before we discuss the solution to address the issue. Also, whether and how to apply filtering should be discussed after proposal 1-4 and 1-5. Therefore, we suggest to deprioritize the discussion in this meeting. | I also think RAN1 should have the same understanding on ping-pong issue, so we can wait for RAN2 a bit.  On the other hand, the discussion here would be useful as a starting point of the discussion next meeting. Let’s see the situation |
| Google | We do not think filtering related needs to be studied. L1-RSRP measurement behaviour should be the same as legacy. | I respect your view, but I tried to keep all the table because it is the very first meeting. Hope you could understand this direction |
| OPPO | Support in principle. The measurement results without filtering could cause ping-pong issue likely due to the variation in measurement results. However, a well balance between the reliability and latency shall be considered. | This if definitely for our further study. |
| QC | Support proposal 1-6-v1. This issue is important. Because the cell switch cannot be as fast as intra-cell beam switch to our understanding, e.g. UE loading the new cell configuration may take a few ms. So it is critical to minimize the frequent HO. LS can be sent to RAN4/2 on the cell switch latency number. | This if definitely for our further study. |
| Fujitsu | Support. The necessity of filtering should be studied. |  |
| Apple | Support.  RAN1 can study and justify the need while waiting for RAN2 further inputs on this. |  |
| DOCOMO | Support in principle. |  |
| Lenovo | Support in principle. |  |
| New H3C | Support in principle |  |
| ZTE | We understand that we can study the necessity of filtering to measurement result, but from our point of view, we don’t see a strong need to introduce filtering operation since the main motivation of Rel-18 L1/L2 mobility is to reduce latency, so ping-ping is not a big deal in case of low latency. |  |
| Huawei, HiSilicon | This issue also relates to whether L3 measurement are involved. For example, if L3 can be used to roughly select the candidate cell, the cell level measurement in L1 seems not necessary. As for the time domain filter, it may reduce the responsiveness of L1/L2 mobility which is the major benefit. Moreover, the filtering can be implemented at network side without spec impact.  We share similar view as MTK, it should be deprioritized in this meeting and require more input from RAN2. | Please see my response to MTK |
| LG | Agree with FL’s assessment |  |
| CMCC | OK to defer the discussion and wait for RAN2 to confirm whether “ping-pong avoidance” should be introduced. |  |
| CATT | Agree with FL’s assessment. To avoid the ping-pong issue, filtering for L1 measurement is needed and can be further studied. |  |
| vivo | We share similar view with MediaTek. |  |
| Ericsson | We think this should be deprioritized at this time. Note that ping-pong is only indirectly related to measurement filtering in the UE: there is no immediate execution of a cell change at the reception of a L1 measurement – or any measurement. Note that filtering can be performed in the NW as well. |  |
| Nokia | First of all, we agree that the need of filtering within the L1/L2-based inter-cell mobility framework should be manifested for which we can rely on RAN2 discussions. Even if we agree on supporting filtering, we should discuss it in the context of time type of L1 reporting. Like in beam management, the network can apply an additional filtering for the received L1 beam measurements. This can work in case of periodic L1 beam measurements but not for event-based triggering or aperiodic triggering of L1 beam measurements. Hence UE based filtering may not always be needed.  Also, we propose to remove “impact if UE rotation” as this may not only the cause of ping-pong; therefore, it is not clear why only this specific cause is included in the proposal. | For your first comment, I think it is daintily for further discussion.  Regarding your 2nd comment, I agree that this can be included in “ping-pong”, so OK to remove it. |
| InterDigital | Support FL proposal. Filtering would likely be useful if event-based triggering is supported. |  |
| Samsung | First we should discuss if ping-ponging is an issue that should be considered in RAN1 or RAN2 and how it is considered. There could be multiple ways to address ping-ponging (filtering being one way, hysteresis being another, etc.). With the lower latency of L1/L2 mobility is ping-ponging an issue to begin with (maybe some input is needed from RAN2 on this).  Filtering has its benefits and drawbacks, the benefit being a more stable metric, the drawback being longer latency, those pros and cons should be carefully considered. |  |
| Futurewei | In principle support FL’s proposal. Agree with FL that ping-pong issue for L1/L2 mobility should be aligned with RAN2. |  |
| Intel | If HO is based on L1 measurement without any UE event trigger, then L1-filtering becomes important especially in FR2 where ping-pong effect is a problem as shown in SLS results in our paper. If UE rotation is considered, the ping-pong effect may be quite drastic. Therefore, we support this proposal in general.  For the definition of filtering, we think there is no need to mention L3 filtering since this is L1 specific discussion. The two options of time and spatial domain filtering can be listed for now. | I think your comment on “L3 filtering “ makes sense. |

##### [FL observation]

Companies are basically OK with the direction of FL proposal, but some companies don’t see the strong necessity to agree this proposal at this meeting. Also, it seems that companies’ views on the necessity of filtering are split. (Note FL doesn’t want to count the number of companies because this is something to be done after RAN2 input, hopefully next meeting). Given this situation, FL would update the FL proposal as below but suggest not to discuss it in the GTW on Oct 12. If the discussion is matured until the end of RAN1#110b-e, I will suggest discussing this proposal in GTW for quick approval. Even when this proposal is not agreed in this meeting, there will be no negative impact for our work in this quarter.

##### [FL proposal 1-6-v2]

* For Rel-18 L1/L2 mobility, further study the necessity of filtering to L1 measurement results considering at least the following aspects:
  + Exact definition of filtering
    - ~~L3 filtering (in~~ Time domain filtering~~)~~: e.g. exact definition of time domain filtering
    - Cell-level ~~measurement (in~~ (spatial domain) filtering: e.g. how many beams are averaged, and/or how the beams are chosen.
  + Importance to avoid ping-pong handover for L1/L2 mobility
    - Alignment with RAN2 is expected
  + ~~Impact of UE rotation~~
  + Applicability to L1-RSRP and L1-SINR (if supported)
  + Applicability to intra-frequency and inter-frequency (if supported)
* *FL note: this issue is a medium priority issue, the system will work without this functionality even though it is not optimum. Thus FL recommends not to spending much time on this issue and make our decision at an early stage of Rel-18.*

##### [Discussion on proposal 1-6-v2]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-6-v2 | Response from FL |
| Xiaomi | We do not think it necessary further filter L1 measurement results.  We understand that the L1 measurement results vary fast and we understand the intention of this proposal. But, first, form our understanding, the final handover decision is up to NW and the ping-pong issue could be partly avoided by NW with an appropriate handover decision criterion. Secondly, in L1/L2 mobility, UE is allowed to switch among these cells a little more dynamically than conventional handover.  Therefore, we don’t think this is necessary. | Please focus on the framework discussion here. |
| vivo | The most important thing we should confirm is whether ping-pong handover is an issue that must be solved, which would be discussed in RAN2. If the impact is negligible, it is not essential to discuss this issue. Therefore, this discussion should not be issued until receiving LS from RAN2. | My interpretation of RAN2 agreement (Oct meeting) is that RAN1 should perform our analysis on ping-pong w/o waiting for RAN2 LS.  If so, now we can delete “ Importance to avoid ping-pong handover for L1/L2 mobility Alignment with RAN2 is expected”.  Other companies’ opinion are also welcome. |
| NEC | The short periodicity of L1 measurement, can increase the probability of ping-pong handover. To improve the robustness of L1 measurements, gNB should be able to fine-tune the UE measurement reporting filtering criteria based on the handover performance. gNB may configure how the L1 measurement results are filtered for measurement reporting, e.g. averaged after removing the highest/lowest X percentile measurement values. Note that L1 measurement report filtering may be configured to be performed at the source-DU for inter-cell inter-DU beam management, or at the UE for conditional handover. | I checked my proposal carefully, and I thought your intention is included in “how the beams are chosen”. Hope you are OK with this. |
| Fujitsu | Support. We are fine that RAN1 can also have some discussions on the listed aspects of filtering. |  |
| LG | Fine with the proposal |  |
| Spreadtrum | We do not think it is urgent to discuss. If it is for Ping-pong effect, it can be triggered by RAN2. But we are open to study the filtering. | see comment to vivo |
| Huawei, HiSilicon | Share the view with Xiaomi and Vivo. The discussion on this issue is not urgent, considering so many open issues and limited TU. If companies hope to have such guidance in this meeting, we would like to add additional aspects for considerations.   * Benefit when L3 measurement is involved * Necessity to be specified in standard |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

### Configurations for L1 measurement

##### [Summary of contributions]

* Due to the support of multi-beam/multi-frequency/multi-cell measurements under Rel-18 L1/L2 mobility scenarios, it is required for gNB and UE to handle large amount of measurement (and configuration) in order to find the best beam/cell for mobility. Thus, it is questioned that the number of cells/RSs need to be extended from Rel-17 ICBM.
  + Change the maximum number of additional cells (i.e. non-serving cells)
  + Change the maximum number of RSs associated with each cell that can be configured for L1 measurement
  + Note that if nothing is changed, gNB may be required to perform RRC reconfiguration
* On the other hand, companies also see the necessity to enhance the configuration on L1 measurement to avoid the complication at a gNB, and memory requirement for a UE, e.g.
  + The beam measurements for L1/L2 mobility should require only a minimum of configuration, i.e.
    - Similar approach as L3 measurement: the L3 measurements only require a target frequency, and intra-frequency L3 measurements do not require any configuration at all. In particular, the UE does not need to be informed which PCIs it should measure: the UE finds the SSBs of any relevant PCI without explicit configuration
  + Use MAC CE to activate/deactivate the measurement of reference signals for a cell or the measurement PCIs, and reporting set may also be updated due to this activation.
  + Possibility to reuse pre-configuration for target cell(s), which may include RRC parameters for measurement RS and TCI states
* Furthermore, it is pointed out that the commonality between intra-DU and inter-DU case, where obtaining full RRC configuration for the target cells is not undesirable.

##### [FL observation]

It would be straightfoward to consider to the extention of configured nubmer of PCIs and RSs becuase a UE is required to measure more number of beams for non-serving cells in order to find the best beam/cell for handover. However, there is a trade-off relationship between performance and complexity. Therefore, it is resonable for RAN1 to closely look at this issue, and FL would propose RAN1 to further study this issue, and to find a well-balanced system design on this matter.

##### [FL proposal 1-7-v1]

* For Rel-18 L1/L2 mobility, further study at least the following aspects for the configuration of L1 measurement:
  + Whether to change the maximum number of additional cells (i.e., non-serving cells), which is 7 for Rel-17 ICBM
    - this includes the concept not to indicate any PCIs for L1 measurement
  + Whether to change the maximum number of RSs associated with each cell that can be configured for L1 measurement, which is 64 for Rel-17 ICBM
    - this includes the concept not to indicate any RSs for L1 measurement
  + Whether to introduce enhancements for L1 measurement to avoid a large amount of active measurement configurations or frequent reconfiguration.
  + Whether and how to communize the configuration for intra- and inter-DU case.
* *FL note: this issue is a medium priority issue; the system may work without this functionality even though it is not optimum. It would be good for RAN1 to better understand the problem first.*

##### [Discussion on proposal 1-7-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-7-v1 | Response from FL |
| Google | So far we have not seen a necessity for these study points. | They are proposal from companies, so I have no plan to drop them from Rel-18 at this meeting |
| QC | Suggest to add a new issue below, which we think is important.  Whether the measurement RS for a candidate cell is configured under active serving cell or candidate cell | OK, let’s do it in the next revision |
| Fujitsu | Support in general. Suggest to add an additional FFS aspect as below. It is generally mentioning to study the detailed contents of the measurement configuration  Information required for configuring the measurement RS | OK, let’s do it in the next revision |
| Apple | Support in general. Also suggest to add the bullet proposed by QC. |  |
| DOCOMO | Support in principle. |  |
| Lenovo | Support in principle |  |
| New H3C | Support |  |
| NEC | Support the configuration of a subset of candidate cells to be measured simultaneously. |  |
| ZTE | We propose to first evaluate the necessity of these aspects listed above and then discuss detailed enhancements. | In my understanding, the intention of “evaluate the necessity” has been included by “study further” and “whether”. Hope you are OK for the current wording. |
| Huawei, HiSilicon | Support in princple |  |
| CMCC | Support |  |
| CATT | Support in princple |  |
| vivo | Support in principle. |  |
| Ericsson | We support the direction. Then we note that RAN2 has stated that the solution should be as common as possible – hence there is a strong request from RAN2 that the configuration for intra-DU and inter-DU should be the same.  Since there is some confusion on the configuration possibilities in the intra-DU and inter-DU case, we propose to send an LS to RAN2/RAN3 to ask:   * For Rel-18 L1/L2 mobility, further study at least the following aspects for the configuration of L1 measurement:   + Whether to change the maximum number of additional cells (i.e., non-serving cells), which is 7 for Rel-17 ICBM     - this includes the concept not to indicate any PCIs for L1 measurement   + Whether to change the maximum number of RSs associated with each cell that can be configured for L1 measurement, which is 64 for Rel-17 ICBM     - this includes the concept not to indicate any RSs for L1 measurement   + Whether to introduce enhancements for L1 measurement to avoid a large amount of active measurement configurations or frequent reconfiguration.   + Whether and how to communize the configuration for intra- and inter-DU case.     - Send an LS to RAN2/RAN3 to ask under what circumstances an intra-DU configuration method can be used also for the inter-DU case. | I’m fine to suggest sending LS to RAN2/3 given the situation this week. However, your proposed sentence is not clear to me… Let me suggest different expression in the 2nd round discussion. |
| Nokia | Support in principle. |  |
| InterDigital | Support |  |
| Samsung | For intra-cell scenarios, 7 cells is probably good enough. For inter-cell scenarios, we would most likely need to increase the number of cells. This would depend on the network deployment and architecture. Probably 32 would be good enough. | This aspect can be discussed in the next meeting. Let keep other companies’ proposal on the table for now. |
| Futurewei | Support in principle. |  |
| Intel | Agree with the general direction of this proposal. |  |

##### [FL observation]

During the 1st round discussion, the following points are requested.

* To clarify “evaluation on necessity” is necessary
* Request to add more aspects
* Necessity to send LS to RAN2/3

For the 1st point, FL thinks the intention has already included in the v1 proposal. FL sees no need to add further sentence, but of course, companies’ comments are welcome.

For the 2nd point, Companies proposals are simply added as requested. Please check if the revision is OK to you.

For the 3rd point, the proposed sentence is captured in the proposal v2 with square bracket. Given the comments in the 1st GTW, it would be good if this point can be clarified as soon as possible. On the other hand, FL is afraid that companies don’t have common understanding even what RAN1 should ask at this moment, which means that we should wait for one meeting and send an LS in November. The draft LS (based on Ericsson’s input) is captured below, so FL would like to check if we are ready to send an LS in this meeting.

##### [FL proposal 1-7-v2]

* For Rel-18 L1/L2 mobility, further study at least the following aspects for the configuration of L1 measurement.
  + Whether to change the maximum number of additional cells (i.e., non-serving cells), which is 7 for Rel-17 ICBM
    - this includes the concept not to indicate any PCIs for L1 measurement
  + Whether to change the maximum number of RSs associated with each cell that can be configured for L1 measurement, which is 64 for Rel-17 ICBM
    - this includes the concept not to indicate any RSs for L1 measurement
  + Whether to introduce enhancements for L1 measurement to avoid a large amount of active measurement configurations or frequent reconfiguration.
  + Whether and how to communize the configuration for intra- and inter-DU case.
  + Whether the measurement RS for a candidate cell is configured under active serving cell or candidate cell.
  + Information required for configuring the measurement RS
* Send an LS to RAN2/RAN3 asking the clarification on intra-/inter-DU scenario:
  + RAN1 starts the discussion on the configuration for L1 measurement for candidate cells.
  + The following RAN2 agreements are captured in RAN2 LS (R1-2208331/R2-2209257). However, it is not clear for RAN1 which kind of information/configuration for candidate cell(s) are available at serving cell for inter-DU case for Rel-18 L1/L2 mobility. Thus, companies have different understanding on the implication “as much commonality as reasonable” in the LS.
    - *Confirm to Support L1/L2-based inter-cell mobility for inter-DU scenario (as well as intra-DU scenarios).*
    - *The design for intra-DU and inter-DU L1/L2-based mobility should share as much commonality as reasonable. FFS which aspects need to be different.*
  + RAN1 kindly asks RAN2 and RAN3 to provide under what circumstances an intra-DU configuration method can be used also for the inter-DU case.
* *FL note: this issue is a medium priority issue; the system may work without this functionality even though it is not optimum. It would be good for RAN1 to better understand the problem first.*

##### [Discussion on proposal 1-7-v2]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-7-v2 | Response from FL |
| Xiaomi | Based on the LS from RAN2, there are three possible configuration models:   * Current options on the table: to configure a L1/L2 inter-cell mobility candidate cell:   a. One RRCReconfiguration message for candidate target cell  b. One CellGroupConfig IE for each candidate target cell  c. One SpCellConfig IE for each candidate target cell  It seems that RAN1 pays too much attention on R17 configuration model.  The configuration of L1 measurement can be discussed after the configuration model is decided by RAN2. Or, we can first decide which configuration model RAN1 wants to support and send LS to RAN2. Then, we can discuss the detail issues of configuration. | I’m a bit confused with your comment. My understanding is that the question is the feasibility of obtaining RRC configuration of candidate cells for inter-DU case. |
| vivo | For the sub-bullet of “ Whether the measurement RS for a candidate cell is configured under active serving cell or candidate cell”, we think it is a RAN2 issue and according to the description, no useful information is provided since it covers all possible schemes. Therefore, we suggest to removing this sub-bullet. | In understanding, this is a discussion to decide the parameter structure. RAN1 should design the principle and then RAN2 will determine ASN.1. In this sense, I don’t think this is pure RAN2 issue.  On the other hand, I tend to agree that RAN1 has to work on this aspect without this sentence. If this cause some confusion, I’ m OK to remove this. |
| Fujitsu | Support. |  |
| Spreadtrum | Support |  |
| Huawei, HiSilicon | As for the bullet of “Whether the measurement RS for a candidate cell is configured under active serving cell or candidate cell”, not quite sure the meaning of “configured under”. Does not mean the signalling structure, like RS associated with a PCI of candidate cell, or even the configuration itself are received from candidate cell?  For the clarification of RAN2 LS, seems companies only have confusion on the “*The design for intra-DU and inter-DU L1/L2-based mobility should share as much commonality as reasonable. FFS which aspects need to be different.*”. then the subbullet above can be deleted. |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

### LS to RAN2,3 and 4

##### [FL observation]

Through the 1st round discussion, many companies proposed to send an LS to RAN2/(3,4) to inform them of our agreements. Given this situation, FL would like to propose the following:

##### [FL proposal 1-8-v1]

* Send an LS to RAN2, 3 and 4 to inform them of the agreements under A.I 9.12.1 and A.I. 9.12.2
  + If the LS related proposal in proposal 1-1, 1-2 and 1-7 are agreed, the contents are also included.

##### [Discussion on proposal 1-8-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 1-8-v1 | Response from FL |
| Xiaomi | OK |  |
| vivo | Besides proposal 1-1,1-2 and 1-7, we think the agreement of other issues should also be added into the LS, if achieved. Since all of them may make specification impact for RAN2/3/4. | Yes, this is exactly my intention. |
| Fujitsu | Support. |  |
| LG | Same understanding with vivo |  |
| Spreadtrum | Support to inform, the set of agreements can be decided later, to check if they are related with RAN2/3/4 discussion. |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## L1 measurement reporting

##### [Summary of contributions]

* According to the submitted contributions that many companies have an understanding that the gNB triggered/configured reporting, which is supported for Rel-17 ICBM, can be reused for Rel-18 L1/L2 mobility
  + Periodic, semi-persistent and aperiodic L1 measurement reporting using reference signals associated with non-serving cell PCI
  + Reuse the reporting format for Rel-17 ICBM, i.e. 4 beams can be reported in a report instance, including serving cell and non-serving cell, where absolute 7-bit RSRP and remaining 4-bit differential RSRP value relative to the absolute value
  + Also, there are discussions about the reporting format to support Rel-18 scenarios
    - Frequency indicator if inter-frequency L1 measurement is supported.
    - Support of more than 4 beams in a report instance.
    - Support of reporting a variable number of SSBRI/RSRP pairs, wherein a UE reports in a single reporting instance a two-part beam report using the Rel-15 two-part UCI. The 1st part has fixed payload size while the 2nd part is used to report the remaining information.
    - Support reporting for top N candidate cells with cell-level filtered measurement results.
* On the other hand, L1 measurement report using MAC CE is also proposed to enable large size of reports, and to achieve more reliability.
* In addition, many companies propose to introduce UE /event triggered report (which was discussed in Rel-17 ICBM but not agreed) to reduce reporting overhead and UE power consumption while it is claimed that the motivation of event triggered L1 reporting is not clear.
  + Nevertheless, companies have quite different understanding on the detailed design: i.e. triggering event (reuse of L3 event, or new event, etc.), resources allocation/request used for reporting, indication to gNB if the condition is met (using SR or MAC CE), how to start or stop the report (timer base), how the target RS and PCI is configured, necessity of TTT (Time To Trigger) and/or contents of the beam report etc.

##### [FL observation]

There are small number of proposals on L1 measurement report in this meeting. Some companies propose to reuse the mechanism for Rel-17 ICBM (i.e. reporting format). On top of that, some also see the necessity to enhance it to support Rel-18 scenarios (such as inter-frequency handover which may result in large number of measurement and report). Another idea to cope with Rel-18 scenario is to use MAC CE to enable large amount of L1 measurement report with higher reliability.

Event/UE triggered report was proposed by many companies, similarly to Rel-17. While this technique is well-known in RAN1 for a long time, it seems companies still have quite different views on the details design of UE /event triggered report (despite the simple name, unfortunately). This situation prevents FL from coming up with concrete options for UE /event triggered report (i.e. option 1, option 2 ~~) for down selection because tons of combinations can be considered. Therefore, FL would like to propose two phase approach, i.e. (1) summarize and agree the discussion points at this meeting, and (2) discuss and decide if event/UE triggered report is supported or not, and agree the limited number of options for further discussion at RAN1#111. Spending much time on this issue is not recommended.

##### [FL proposal 2-1-v1]

* For L1 measurement report for Rel-18 L1/L2 mobility, further study the following mechanisms:
  + Report as UCI on PUCCH or PUSCH
    - Periodic report on PUCCH, semi-persistent report on PUSCH and aperiodic report on PUSCH
    - Reuse the report format defined for Rel-17 ICBM, and further study the enhancements to accommodate Rel-18 scenarios, e.g.
      * Inter-frequency measurement, if supported
      * Increasing the maximum number of reporting beams, which is 4 for Rel-17 ICBM
      * Reducing the reporting overhead by e.g. choosing N-best beams/cells
  + Report on MAC CE
* For L1 measurement report for Rel-18 L1/L2 mobility, interested companies are encouraged to further study the necessity of UE/event triggered report for L1 measurement results and the detailed design until RAN1#111
  + At least the following aspects should be considered in the companies’ proposal
    - Exact definition of events, i.e. events defined for L3 measurement report, or something new
    - Report container i.e. UCI transmitted on PUCCH or PUSCH and/or MAC CE etc.
    - Resource allocation/assignment for UE/event triggered report i.e. resource is allocated in advance, requested when the event is met, and/or activated when the condition is met etc.
    - Necessity of indication to gNB when the condition is met, and how
    - Necessity to define the condition to start/stop the reporting, e.g. timer
    - Necessity of time to trigger
    - Contents of the report/reporting format, PCI, RS ID, measurement result etc.
* *FL note: this issue is a high priority issue; at least one container shall be defined. On the other hand, UE event triggered report look like an optimization. Thus FL doesn’t recommend spending much time on this issue.*

##### [Discussion on proposal 2-1-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal2-1-v1 | Response from FL |
| Google | We think the following bullet should be removed:   * + - * Reducing the reporting overhead by e.g. choosing N-best beams/cells   For event-based report, since this is L1 measurement report, we think the definition of event should be based on L1 measurement report instead of L3 measurement report. | Please see my reply in Proposal 1-6-v1 to you. This is a proposal by a company, and I have no plan for down-selection in this meeting. |
| QC | Suggest a few changes as below. R17 report format may not be reused for inter-frequency, which may report top X best beams/cells per frequency for multiple frequencies in the same report   * + - Reuse the report format defined for Rel-17 ICBM at least for intra-frequency measurement, and further study the enhancements to accommodate Rel-18 scenarios, e.g.       * Inter-frequency measurement, if supported       * Increasing the maximum number of reporting beams, which is 4 for Rel-17 ICBM   Reducing the reporting overhead by e.g. choosing N-best beams/cells per frequency or across frequencies | OK, let’s do it in the next revision. |
| Fujitsu | Support |  |
| Apple | Support in general.  This provides a simply list for the potential study areas and whether adopt or not is a sperate discussion. |  |
| DOCOMO | Suggest adding a following bullet in the end, as we need to decide whether such event is for legacy L1 measurement/reporting or filtered L1 measurement/reporting.   * + - The interaction with filtered L1 measurement results (if supported) | OK, let’s do it in the next revision. |
| Lenovo | Support in principle |  |
| New H3C | Support |  |
| NEC | Support that a timer is started for the candidate cell SSB measurements upon receipt of the L1/L2 mobility configuration. The timer expires when no handover is triggered.  Support that L1 measurement results are filtered for measurement reporting, e.g. averaged after removing the highest/lowest X percentile measurement values | Sorry if I’m wrong, but is this proposal intended for 5.1.6?. Please give me your specific proposal where to add this. Then, I’m happy to include it. |
| ZTE | Regarding report format, we suggest that report format for Rel-17 ICBM can be used as starting point, since Rel-17 ICBM just support non-group based report method, not support group-based report method. So at this stage, we think these two report method should be considered. |  |
| Huawei, HiSilicon | We support the first part of proposal.  As for the event triggered report, we agreed width moderator’s assessment. It is an optimization and the benefit are quite related to the amount of report, such as number of candidate cells and whether L3 measurement can be used in advanced. |  |
| LG | Fine with the proposal |  |
| CMCC | In our view, report as UCI and report on MAC-CE are two options. Is the intention to do down-selectin between the two options? | It depends on our further discussion. At this moment, my understanding is that these options are not exclusive. |
| CATT | General fine with the proposal.  Just for clarification for the 2nd part, why do we need to add RAN1#111 for the event triggered report? Does that mean we need to final decide whether to support event triggered report and decide all following sub-bullets in the next meeting? | Please see my reply in [FL observation] below |
| vivo | In general, P/SP/AP L1 measurement report is carried by PUCCH/PUSCH. We don’t understand the motivation of reporting on MAC CE. Therefore, we suggest to removing the wording “ Report on MAC CE” in the first bullet. | The proposal is based on companies’ contribution. So my suggestion is to keep MAC CE at this meeting. |
| Ericsson | Support.  We think that event-driven reporting can be important to reduce signalling in UL: the scenario we foresee is ~100 UEs sending one report every 40ms – this would be difficult to handle.  If we foresee that the content of the measurement report is larger, MAC CE would be relevant. Then we note that provided that if we define a measurement report over MAC CE, event-driven can be added as a next step. |  |
| Nokia | Similar to Google, we also think We think the following bullet should be removed or more details should be added to make it more clear (like reducing with what reference?)   * Reducing the reporting overhead by e.g. choosing N-best beams/cells   For the reporting format, it depends on the approach to be followed in section 5.1.7. If the existing measurement and reporting configuration based approach is used then Rel-17 ICBM reporting format can be reused; otherwise, this needs to revisited if an approach where PCIs, associated RS ID, and measurements need to be indicated in the reports.  For the legacy periodic/semi-persistent/aperiodic type reporting, existing PUCCH and PUSCH based containers can be reused. MAC-CE can be a potential option for event triggered reporting. | The proposal is based on companies’ contribution. So I have no intention to remove some specific proposal at this meeting. The detailed analysis and discussions are expected in the next meeting. |
| InterDigital | Support.  Event-driven reporting is motivated by the need to avoid overhead from frequent reporting. |  |
| Samsung | Given the limited TU for this feature, we should try to reuse the reporting mechanisms of ICBM (e.g., L1-based report with enhancements). We also support further studying two-part UCI and the corresponding details – it is need for various Rel-18 scenarios discussed above.   * + - Reuse the report format defined for Rel-17 ICBM, and further study the enhancements to accommodate Rel-18 scenarios, e.g.       * Inter-frequency measurement, if supported       * Increasing the maximum number of reporting beams, which is 4 for Rel-17 ICBM       * Reducing the reporting overhead by e.g. choosing N-best beams/cells       * Two-part UCI: e.g., the 1st part contains the best beam/cell and the number (e.g., N) of reported beams/cells, the 2nd part contains the rest (N – 1) beams/cells.   We are fine to study event-driven reporting. | I will add your proposal in the next revision |
| Futurewei | In principle, FL’s proposal is fine with us. We think L1 measurement phase for L1/L2 mobility is very important, its outcome would be determination of the target cell and target beam, as well as DL synchronization with the target cell/beam. It is critical to reduce the measurement and target cell/beam determination delay. We suggest to study the solution to reduce the delay at L1 measurement phase. |  |
| Intel | We think event triggered reporting can be important mechanism to avoid unnecessary overhead. We support the proposal in general since it lists study points. For event triggered reporting, we should remove RAN1#111 as a checkpoint. | Regarding the checkpoint in RAN1#111, please see [FL observation] below: |

##### [FL observation]

There are a couple of suggestions for FL proposal 2-1-v1:

* Adding missing proposals from companies (my apologies for missing these proposals)
* Removal of checkpoint RAN1#111

The request from companies have been added in FL proposal 2-1-v2. Companies are encouraged to check if the revision is OK.

As for the checkpoint, the intention of FL is as follows:

* Many companies are interested in even/UE trigger report. However, the most of the companies did not discuss about the details, especially for the event.
* This discussion can be a pure RAN1 discussion, i.e. no dependency with RAN2. Compared with other topics, good progress can be expected in Nov meeting.
* However, without the lack of detailed design, good progress in November meeting cannot be expected.
* Also, FL expect that even/UE trigger report wouldn’t be a simple functionality. Multiple meetings would be required to finalize the standardization.

Given this background, FL wanted to encourage to bring a “complete” proposal to RAN1#111. FL would like to ask companies again if we can keep RAN1#111 as a checkpoint.

##### [FL proposal 2-1-v2]

* For L1 measurement report for Rel-18 L1/L2 mobility, further study the following mechanisms:
  + Report as UCI on PUCCH or PUSCH
    - Periodic report on PUCCH, semi-persistent report on PUSCH and aperiodic report on PUSCH
    - Reuse the report format defined for Rel-17 ICBM at least for intra-frequency measurement, and further study the enhancements to accommodate Rel-18 scenarios, e.g.
      * Inter-frequency measurement, if supported
      * Increasing the maximum number of reporting beams, which is 4 for Rel-17 ICBM
      * Reducing the reporting overhead by e.g. choosing N-best beams/cells per frequency or across frequencies
      * Two-part UCI: e.g., the 1st part contains the best beam/cell and the number (e.g., N) of reported beams/cells, the 2nd part contains the rest (N – 1) beams/cells.
  + Report on MAC CE
* For L1 measurement report for Rel-18 L1/L2 mobility, interested companies are encouraged to further study the necessity of UE/event triggered report for L1 measurement results and the detailed design [until RAN1#111]
  + At least the following aspects should be considered in the companies’ proposal
    - Exact definition of events, i.e. events defined for L3 measurement report, or something new
    - Report container i.e. UCI transmitted on PUCCH or PUSCH and/or MAC CE etc.
    - Resource allocation/assignment for UE/event triggered report i.e. resource is allocated in advance, requested when the event is met, and/or activated when the condition is met etc.
    - Necessity of indication to gNB when the condition is met, and how
    - Necessity to define the condition to start/stop the reporting, e.g. timer
    - Necessity of time to trigger
    - Contents of the report/reporting format, PCI, RS ID, measurement result etc.
    - The interaction with filtered L1 measurement results (if supported)
* *FL note: this issue is a high priority issue; at least one container shall be defined. On the other hand, UE event triggered report look like an optimization. Thus FL doesn’t recommend spending much time on this issue.*

##### [Discussion on proposal 2-1-v2]

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 2-1-v2 | Response from FL |
| Xiaomi | Ok with FL proposal 2-1-v2 |  |
| CATT | For the checkpoint RAN1#111, we still have concern on how we can finalize the necessity and the detailed design study of UE/event triggered report based on the huge aspects listed in the proposal in only one meeting.  We think we can make a decision at RAN1#111 whether to support UE/event triggered report or not just based on the analysis of benefit and drawback of UE/event triggered report. If support, we can further discuss the detail design in the future meetings. | Regarding the checkpoint, let’s see other companies view. My ambitions is to agree whether or not event/UE trigger is introduced in Rel-18 at RAN1#111, and the details can be discussed later. |
| NEC | For L1 measurement and reporting, propose to support that a timer is started for the candidate cell SSB measurements upon receipt of the L1/L2 mobility configuration. The timer expires when no handover is triggered.  The shorter periodicity of the L1 measurements in inter-cell handover increases the signaling overhead and energy consumption of the UE, due to the number of measurements and amount of reporting performed for the candidate cells. The problem becomes worse if the handover is delayed, or does not happen due to radio link condition. | I think your proposal is to introduce timer for event/UE trigger report. Hope the current proposal includes your intention. |
| Fujitsu | Support. |  |
| ZTE | According to the latest conclusion of RAN2, it seems that we can add inter-frequency case in the current proposal.  Besides, for “until RAN1#111”, it is not clear for us what “until RAN1#111” mean. Does it mean that whether event triggered report method is supported will be decided in the next meeting, or just suggest the companies can further provide their views on necessity or pros and cons in the next meeting.  Regarding   * + - Exact definition of events, i.e. events defined for L3 measurement report, or something new   We propose updating “events defined for L3 measurement report” as “events defined for L3 event triggered report”.  Finally, suggest changing “i.e.” in proposal to “e.g.,”. | RAN2 agreement says “Inter frequency scenario” is supported, but no mention about measurement. RAN1 should agree to support inter-frequency measurement, and the current working is not contradicting.  For the checkpoint, please see my reply to CATT  OK for “events defined for L3 event triggered report”  OK to use “e.g.,” |
| New H3C | OK in principal |  |
| LG | Fine with the proposal |  |
| Spreadtrum | Support |  |
| CMCC | For the bullets of the aspects for UE/event triggered report, we think all the “i.e.” can be changed to “e.g.”. |  |
| Huawei, Hisilicon | We need to set a check point to at least determine whether even triggered report should be supported or not, if companies think the detail may be that quick. Thus, we can adjust the main bullet as  For L1 measurement report for Rel-18 L1/L2 mobility, interested companies are encouraged to further study the necessity of UE/event triggered report for L1 measurement results [until RAN1#111] and the detailed design  As for aspects for further considering, we would like to add   * Benefit when L3 measurement is involved |  |
|  |  |  |
|  |  |  |
|  |  |  |

## Beam indication

### Beam indication mechanism:

##### [Summary of contributions]

* Many companies think the beam indication at target cell(s) (this includes SpCell and SCell(s) as agreed in RAN2) is performed based on Rel-17 TCI framework (Option. A below). Meanwhile, it is also pointed out that Rel-15 TCI framework (Option. B below) needs to be considered if Rel-17 TCI framework cannot be a prerequisite for Rel-18 L1/L2 mobility.
  + **Option A:** Beam indication for Rel-18 L1/L2 mobility is designed based on Rel-17 TCI framework mechanism
    - RRC configurations of DL/UL/joint TCI states for potential target cell(s) are activated by MAC CE, and indicated by DCI
    - Potential issues pointed out by companies
      * Coexistence with Rel-17 inter-cell beam mTRP
      * Support of CA, i.e. how to perform beam indication for multiple cells
      * Handling of common-PDCCH (which cannot be switched to non-serving cell in Rel-17)
      * How and whether the list of TCI states associated with target cell(s) is/can be configured, including whether the TCI states for target cell(s) are availble or not
      * Application time for new beam activation need to be updated compared with Rel-17 ICBM.
  + **Option B:** Beam indication for Rel-18 L1/L2 mobility is designed based on Rel-15 TCI framework mechanism
    - TCI indication is valid only for a certain channel, and update by RRC reconfiguration is required to update QCL/Tx spatial filter/pathloss reference.
    - Detailed mechanism and potential issues need further discussion (i.e. the details are not discussed by the contributions submitted to this meeting)
* Alt.1 and Alt.2 may or may not be exclusive to each other. Choosing Option A only (i.e. Rel-17 TCI framework as baseline) will make the specification simpler, but Choosing Option A+B will make the deployment and implementation (at least for network side) easier resulting in earlier market introduction.
* There is a proposal that discussion on potential L1 signaling design and enhancements on L1 measurement/reporting related to dynamic serving cell switch should be deprioritized till further RAN2 inputs are provided.

##### [FL observation]

While many companies assume Rel-17 TCI framework can be the baseline for Rel-18 L1/L2 mobility, it should be firstly decided if Rel-18 L1/L2 mobility should assume a specific TCI framework, i.e. whether Rel-15 TCI framework need to be considered. FL thinks the decision on this matter is very important for this WI because it has a big impact for the whole design of Rel-18 L1/L2 mobility. As already indicated by RAN2 LS, prerequisite discussion has already happened in RAN2 and the same situation is expected for TCI framework assumption. In this sense, FL believes the RAN1 discussion should be hold a bit until RAN2 concludes their discussion. Note that FL confirmed that a RAN2 contribution bringing up this issue is submitted to RAN2#119b-e, and hence no LS from RAN1 would be necessary.

##### [FL proposal 3-1-v1]

* RAN1 to further study if the beam indication of target cell(s) L1/L2 mobility should be designed for a specific TCI framework, e.g. Rel-17 unified TCI, and their potential spec impact. RAN1 discussion will be commenced after receiving RAN2 LS.
* Interested companies are encouraged to work with their RAN2 colleagues to accelerate the discussion.
* *FL note: FL doesn’t see a strong necessity to make any agreement/conclusion for this proposal at this meeting while some email discussion is expected in this meeting. The result of the email discussion will be used as a reference for RAN1#111.*
* *FL note: this issue is a high priority issue.*

##### [Discussion on proposal 3-1-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 3-1-v1 | Response from FL |
| MediaTek | Agree with FL’s assessment that the discussion should wait for RAN2 LS. The discussion of TCI framework has essential impact on the design of dynamic cell switching discussion in RAN2 and we prefer to wait for RAN2’s input. |  |
| Google | We think “e.g.” should be replaced by “i.e.” since the enhancement is based on ICBM according to WID, where ICBM is based on unified TCI. In addition, what is the RAN2 LS mentioned in this proposal? | According to my reading, a company questioned that Rel-17 unified TCI can/should be used here. I understand quite a few companies assume Rel-17 TCI framework, but I can’t say this is a consensus at this moment. Let’s see other companies’ opinion  RAN2 LS here means that RAN2 will send an LS after Oct meeting. I expect RAN2 will have a discussion on this matter and the result is included there. |
| OPPO | How to indicate beam indication for L1/L2 mobility target cell critically depends on the L1/L2 mobility handover procedure and handover command design. We are not sure if the Rel-17 Unified TCI can be used here.  Furthermore, inter-cell BM is supported in Rel-17 Unified TCI, how to coordinate between the inter-cell BM and beam indication for L1/L2 mobility shall be carefully considered. | I think you are not the only company to identify this issue. I believe this can be discussed further. |
| QC | Fine for the proposal. However, to our understanding, this should be best decided in RAN1 | The reason why I propose to discuss RAN2 first is that the discussion in RAN2 is ongoing and the duplicated work is expected given the situation. I’m fine to discuss this issue in RAN1, but if so, RAN2 should indicate it. |
| Fujitsu | Support |  |
| Apple | Our view is that unified TCI framework is an optional feature and should not be a pre-requisite for L1/L2-based handover feature. Therefore, the design should support both legacy TCI framework and Rel-17 unified TCI.  We also share QC’s view that this should be decided in RAN1. | Please see my reply to QC. |
| DOCOMO | We tend to agree with QC that the TCI framework should be discussed in RAN1. | Please see my reply to QC. |
| Lenovo | We agree with QC and DOCOMO that the TCI framework should be decided by RAN1.  The WID says to specify “L1 enhancements for inter-cell beam management” which is based on Rel-17 unified TCI framework; therefore, we think L1/L2 mobility should be specified based on unified TCI framework. | Please see my reply to QC. |
| New H3C | The TCI framework should be discussed in RAN1. |  |
| ZTE | We tend to discuss this issue in RAN1, not after receiving RAN2 LS. |  |
| Huawei, HiSilicon | The TCI frame can be decided by RAN1. To our understanding, unified TCI framework in Rel-17 is more efficient to indicate beam for multiple channels/signals in multiple cells from the perspective of signalling overhead. Considering the difference between unified TCI framework and R15 TCI framework, developing L1/L2 measurement for both may result large work load considering limited TU. We support to design based on R17 unified TCI frame work with high priority. |  |
| LG | We have a similar view with QC’s comment |  |
| CMCC | We agree with other companies that the TCI framework should be decided by RAN1. |  |
| CATT | We think the TCI framework should be decided in RAN1 and we prefer to design based on Rel-17 unified TCI. |  |
| vivo | We prefer L1/L2 mobility based on unified TCI framework as starting point. |  |
| Ericsson | In our view, RAN1 can start the discussion without waiting for additional input from RAN2. |  |
| Nokia | We prefer to start the discussion in RAN1 as this is more of a RAN1 topic. Our preference is to have less specification impact, i.e., option A (mentioned in the summary of contributions) where serving DU can be made aware of TCI states of other DU’s cells and then Rel-17 based TCI framework can be reused (with necessary enhancements) to configure TCI states of other cells. |  |
| InterDigital | Agree that RAN1 can start the discussion without waiting. |  |
| Samsung | Given limited TU, we should try to reuse ICBM framework (based on unified TCI framework) as much as possible. We don’t see a strong justification to specify for two TCI frameworks  We think that if beam indication of target cell(s) L1/L2 mobility is supported during or before handover command, it is supported by the Rel-17 TCI framework. |  |
| Futurewei | We have similar view as Qualcomm, and think TCI frame work is in general under the RAN1 scope. |  |
| Intel | We think this can be decided by RAN1 and Unified TCI framework should be used as the baseline for supporting L1/L2 mobility. |  |

##### [FL observation]

The main discussion point in the 1st round was the following:

* **Issue 1:** Whether RAN1 should wait for RAN2 decision on the assumption of Rel-17 Unified TCI framework
  + Yes (wait for RAN2 input, FL’s proposal ) --- **2**
    - MTK, Fujitsu (support FL)
  + No (RAN1 should discuss and start our work) --- **15**
    - QC, Apple, DOCOMO, Lenovo, New H3C, ZTE, Huawei, LG, CATT, CMCC, Ericsson, Nokia, InterDigital, Futurewei, Intel
* **Issue 2:** Whether or not UE support of Rel-17 Unified TCI framework should be assumed
  + Note: FL doesn’t count the number of companies because some companies explicitly mentioned their opinion in this round.

Given the situation above, clear majority of companies want to discuss this issue in RAN1 without waiting for RAN2 input. Given this situation, FL would like to update the FL proposal 3-1 as follows.

##### [FL proposal 3-1-v2]

* RAN1 to further study if the beam indication of target cell(s) L1/L2 mobility should be designed for a specific TCI framework below, ~~e.g. Rel-17 unified TCI,~~ and their potential RAN1 spec impact. ~~RAN1 discussion will be commenced after receiving RAN2 LS.~~
* ~~Interested companies are encouraged to work with their RAN2 colleagues to accelerate the discussion.~~
  + **Option A:** Beam indication for Rel-18 L1/L2 mobility is designed based on Rel-17 TCI framework mechanism
  + **Option B:** Beam indication for Rel-18 L1/L2 mobility is designed based on Rel-15 TCI framework mechanism
  + **Option C:** Beam indication for Rel-18 L1/L2 mobility is designed based on both Rel-15 and Rel-17 TCI framework mechanism
* This does not request RAN2 to suspend their work on the assumption of TCI framework.
* An LS to RAN2 will be sent when RAN1 recommendation is ready.
* *~~FL note: FL doesn’t see a strong necessity to make any agreement/conclusion for this proposal at this meeting while some email discussion is expected in this meeting. The result of the email discussion will be used as a reference for RAN1#111.~~*
* *FL note: this issue is a high priority issue.*

##### [Discussion on proposal 3-1-v2]

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 3-1-v2 | Response from FL |
| Xiaomi | Fine with proposal 3-1-v2 |  |
| vivo | Support updated FL proposal. |  |
| Fujitsu | Support. |  |
| ZTE | Share an information on the latest conclusion from RAN2   * RAN2 assumes that whether to use the unified TCI framework as the baseline for beam indication for L1L2 mobility is up to RAN1 (RAN2 observes that L1/L2 mobility need to support inter-freq cases).   Besides, we are fine with FL proposal. | Thanks for information. Yes, I’m aware of the conclusion.  maybe last 2 bullet’s “This does not~” and “An LS ~” are not necessary anymore. |
| New H3C | Ok in principal. |  |
| CATT | Fine with FL proposal 3-1-v2 |  |
| CMCC | Support the updated proposal. |  |
| Huawei, Hisilicon | Considering the RAN2 progress, maybe the following sentence can be deleted.  This does not request RAN2 to suspend their work on the assumption of TCI framework.  As for sentence of “An LS …” , I think we will do that even if there is no such sentence. |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

### Timing of beam indication:

##### [Summary of contributions]

* Many companies assume that the beam indication for the target cell(s) comes together with L1/L2 cell switch command. Meanwhile, it is also proposed that the beam indication can be performed before the command is received. These mechanisms are useful to reduce the handover latency due to the beam search procedure.
* Also, the necessity of beam indication after L1/L2 mobility command is also discussed in the case where L1 measurement results for target cells are not available when the command is sent. For example, support of cell level L1 measurement and the use of L3 measurement are also proposed and if so, it is not clear if the gNB has a sufficient information which beam is the best for a UE. In this case, the beam indication at the target cell(s) may be performed after the handover command is sent out (i.e. target cell is determined but exact beam is not determined). However, it is not clear at this moment if this is a valid scenario.

##### [FL observation]

RAN2 is now discussing the time chart after enhancement, and timing of beam indication is an open issue. Hence, RAN2 view is important to make the final decision at RAN1 on the timing of beam indication. Given this situation, RAN1 should not have any specific assumption on the timing of beam indication at this moment, and the detailed discussion can be started after receiving RAN2 LS. RAN1 can keep the following 3 scenarios below for now, and FL would encourage interested companies to further study the validity of the scenarios and potential RAN1 spec impacts until then.

* Scenario 1: Beam indication before command
* Scenario 2: Beam indication together with command
* Scenario 3: Beam indication after command

##### [FL proposal 3-2-v1]

* From RAN1 perspective, the following scenarios can be considered for Rel-18 L1/L2 mobility for beam indication timing. This will be updated depending on RAN2 decision on the time chart
  + Scenario 1: Beam indication before command
    - This scenario happens when, e.g. Rel-17 ICBM is enabled before receiving handover command.
  + Scenario 2: Beam indication together with command
    - This scenario happens when, e.g. the best/appropriate beam for a UE is known to the source cell when the commend is sent to the UE.
  + Scenario 3: Beam indication after command
    - This scenario happens when, e.g. the best/appropriate beam for a UE is not known to the source cell when the L1/L2 mobility command is sent to the UE
* Interested companies are encouraged to further study the validity of the scenarios and the potential spec impact.
* *FL note: FL doesn’t see a strong necessity to make any agreement/conclusion for this proposal at this meeting while some email discussion is expected in this meeting. The result of the email discussion will be used as a reference for RAN1#111.*
* *FL note: this issue is a high priority issue*

##### [Discussion on proposal 3-2-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 3-2-v1 | Response from FL |
| MediaTek | Agree with FL’s assessment that the discussion should depend on RAN2 decision on the time chart decision for dynamic cell switching design. It’s not desirable to have overlapped discussion topics with RAN2. |  |
| Google | Not sure whether a command in addition to beam indication signalling is needed or not. Maybe we can wait to see more details on the command. |  |
| OPPO | How to indicate beam indication for L1/L2 mobility target cell critically depends on the L1/L2 mobility handover procedure and handover command design. We shall wait for RAN2 discussion result. |  |
| QC | For scenario 1, suggest to add one more example, which does not assume ICBM is enabled, e.g. a good beam for a promising candidate cell can be activated before gNB decides to select this candidate cell   Scenario 1: Beam indication before command   This scenario happens when, e.g. Rel-17 ICBM is enabled, or the best/appropriate beam for a candidate cell is known before receiving handover command | OK with the proposal, but given other companies’ input, it would be better to remove the explanation to avoid the confusion. |
| Fujitsu | Support |  |
| Apple | Support in general.  On the other hand, not sure RAN2 will discuss this issue i.e., when L1 HO CMD is transmitted. LS maybe needed to trigger RAN2 discussions by listing these three scenarios to seek for guideline. | Maybe we can send an LS capturing all the agreement in this meeting. That would be sufficient. |
| DOCOMO | Support in principle. And QC’s revision looks good. |  |
| Lenovo | Fine with QC’s version. |  |
| New H3C | Support |  |
| NEC | Support |  |
| ZTE | Agree with QC’s version. |  |
| Huawei, HiSilicon | We think the addition by QC is necessary to differentiate the scenario L1/2 mobility from ICBM in R17. For the option 3, what is the difference from existing HO mechanism? |  |
| LG | QC’s revision seems reasonable. |  |
| CMCC | Support |  |
| CATT | Fine with FL’s assessment and agree with QC’s update. We also think for down-selection we need to wait RAN2 LS. |  |
| vivo | We agree to wait for RAN2 discussion result. For the QC’s revision, we think that “the best/appropriate beam for a candidate cell is known” needs further clarification. |  |
| Ericsson | We support the direction of this proposal. However, the examples seem unnecessary – they only seem confusing.  In our understanding, scenario 2 is needed, since the configuration of the source may not be supported by the target. If scenario 2 is supported, scenario 3 can be supported by legacy. Scenario 1 is an interesting optimization. |  |
| Nokia | We are OK to keep all three options for further study for now. However, given the need of minimizing the HO interruption time which include possible agreement on early DL and UL synchronization, and also the need of minimizing delay between the beam indication acquisition and the use of it to communicate with the target cell, the most suitable option is scenario 2 (beam indication along with the cell switch command). |  |
| InterDigital | Support. |  |
| Samsung | Each scenario has pros and cons. We are fine to also consider supporting multiple scenarios depending on the use case (e.g., scenario 1 and scenario 2)  We think that RAN1 involvement might be limited for scenario 3. |  |
| Futurewei | Agree with QC’s version and Huawei’s point. Suggest to down selection scenarios 1 and 2 for further study. |  |
| Intel | Ok with update from QC. Scenarios 1 and 2 seem to be the relevant ones. For Scenario 3, we think it may be supported by legacy and not sure of RAN1 involvement. |  |

##### [FL observation]

The discussion points in the 1st round is the following aspects:

* Necessity of the detailed description for scenarios
  + this might be just confusing
* Down-selection of scenarios
  + some companies don’t see the necessity of scenario 3 because this is a legacy behaviour and no RAN1 involvement is expected

Given the comments from companies, and the principle that “down-selection could be done from next meeting”, FL would propose to update the proposal as follows. Note there is a proposal to send an LS to RAN2, but this is not captured in proposal 3-2-v2 because it is discussed under 5.1.8 instead.

##### [FL proposal 3-2-v2]

* From RAN1 perspective, the following scenarios can be considered for Rel-18 L1/L2 mobility for beam indication timing. This will be updated depending on further RAN1 assessment and RAN2 decision on the time chart
  + Scenario 1: Beam indication before command
    - ~~This scenario happens when, e.g. Rel-17 ICBM is enabled before receiving handover command , or the best/appropriate beam for a candidate cell is known~~
  + Scenario 2: Beam indication together with command
    - ~~This scenario happens when, e.g. the best/appropriate beam for a UE is known to the source cell when the commend is sent to the UE.~~
  + Scenario 3: Beam indication after command
    - ~~This scenario happens when, e.g. the best/appropriate beam for a UE is not known to the source cell when the L1/L2 mobility command is sent to the UE~~
* Interested companies are encouraged to further study the validity of the scenarios and the potential spec impact.
* *FL note: FL doesn’t see a strong necessity to make any agreement/conclusion for this proposal at this meeting while some email discussion is expected in this meeting. The result of the email discussion will be used as a reference for RAN1#111.*
* *FL note: this issue is a high priority issue*

##### [Discussion on proposal 3-2-v2]

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 3-2-v2 | Response from FL |
| Xiaomi | Ok with proposal 3-2-v2. And we prefer Scenario 2.    According to LS from RAN2, the HO interruption time for L1/L2 mobility is the time from UE receives the cell switch command to UE performs the first DL/UL reception/transmission on the indicated beam of the target cell. To reduce the HO interruption time, the beam of target cell can be indicated as soon as possible.  However, before the handover command, serving cell does not know the target cell yet. Which candidate cell’s beam should be indicated? In addition, scenario1 might mean the beam is indicated when the target cell is decided. While, from our understanding, handover decision is made together with target cell decision. Then why should handover command in sent after the beam indication to increase the latency unnecessarily? | Technical discussion can be started from the next meeting. Please focus on the flamework at this meeting. |
| vivo | Support updated FL proposal. |  |
| Fujitsu | Support. |  |
| Spreadtrum | Support |  |
| Huawei, HiSilicon | Should we unify the term “command”->”cell switch command” to keep consistent across different issues? |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## Cell switch command

##### [Summary of contributions]

* A number of companies proposed the signaling details on cell switch command, and DCI and MAC CE are proposed to carry L1/L2 cell switch command. It is pointed out that RAN1 spec impact is clearly foreseen if DCI is chosen as cell switching command.
* The proponents of DCI think the design would be an extension of Rel-17 unified TCI (activated by MAC CE plus indicated by DCI), and at least the following aspects need to be considered to fit L1/L2 mobility:
  + Incorrect detection of command, then acknowledgement is necessary. FL notes that RAN2 is more appropriate place to discuss if the intention is handover complete message,
  + Configuration and activation of the TCI states for non-serving cells
  + Update of TCI state (QCL RSs) after cell switch
* Meanwhile, there are multiple companies who is supportive for MAC CE due to the following reasons:
  + Better flexibility to extend the capacity to carry more necessary information.
  + It is still challenging to carry at least the identity of target cell and TCI state to be applied in target cell by re-purposing fields in current DCI format.
* When making the decision on the mechanism, it is proposed to consider the following aspects/scenarios, i.e. the design of L1/L2 cell switch command should be common (as much as possible) irrespective of the scenarios below:
  + Support of inter-/intra-DU, inter/intra-frequency scenario
  + Whether the command will trigger DL sync, UL sync and/or beam indication at a target cell as well as cell switch
* Additionally, UE autonomous triggering of cell switch (a.k.a. UE-initiated dynamic cell switch) is also proposed by some companies, which has not been discussed in RAN2 yet. The mechanism is e.g.
  + The UE can indicate a handover request in its measurement report. The cell-switch can be triggered once the measurement report is received by the network.
* Some companies have performed their analyses on the necessary information included in L1/L2 cell switch command. The following is the summary of the information proposed by companies:
  + cell/cell group ID for target cell/cell group
  + SSB Index
  + TCI state for the target cell
  + pointer to a target configuration
  + QCL source (or QCL source switching) for DL reception
  + TA value for the target cell.
  + BWP ID for DL and UL for target cells
  + Activation information of CSI-RS resource setting and CSI reporting
  + Random Access Preamble Index, PRACH Mask Index
  + Handover flag (to differentiate Rel-17 inter-cell mTRP and Rel-18 L1/L2 mobility)
  + Triggering of DL/UL synchronization
* It is noted that one company proposes to that discussion on potential L1 signaling design and enhancements on L1 measurement/reporting related to dynamic serving cell switch should be deprioritized till further RAN2 inputs are provided.

##### [FL observation]

Even though some RAN1 spec impact is foreseen (especially when DCI is selected), FL thinks that this is a RAN2 driven issue and duplicated discussion in RAN1 should be avoided. Thus, FL proposal is to hold the discussion in RAN1 until we receive a RAN2 LS to request RAN1 work. What RAN1 should/can do for now is to perform a technical analysis on the pros/cons for DCI/MAC CE based activation from RAN1 perspective, and to list the necessary information included in the command from RAN1 perspective, which would be useful for RAN2 decision.

Regarding the contents of handover command, it looks that the contents proposed in this meeting are fundamental information of “mobility”, which should be handled by RAN2. FL recommendation is to firstly list the “RAN1 relevant” information, and then to send it to RAN2 as necessary. Then RAN2 will make the decision on the container of L1/L2 cell switch command. If their decision is to use DCI, then RAN1 will start our work on the exact design of the DCI.

##### [FL proposal 4-1-v1]

* From RAN1 point of view, both DCI and MAC CE based L1/L2 cell switch command can be considered, and it is expected that RAN2 will make the final decision on which one to employ.
  + Interested companies are encouraged to perform technical analysis from RAN1 point of view, e.g.
    - Necessary information included in the command, which is relevant for RAN1 discussion
    - Necessary number of bits for the information
    - L1 impact or concern to use DCI or MAC CE for L1/L2 cell switch command
  + An LS can be sent to RAN2, as necessary
* The discussion on UE-initiated dynamic cell switch will be held in RAN2 first. RAN1 discussion can be started after receiving explicit indication from RAN2.
* *FL Note: FL doesn’t see a strong necessity to make any agreement/conclusion for this proposal at this meeting while some email discussion is expected in this meeting. The result of the email discussion will be used as a reference for RAN1#111.*
* *FL note: this issue is a high priority issue, but should be led by RAN2*

##### [Discussion on proposal 4-1-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 4-1-v1 | Response from FL |
| MediaTek | Agree with FL’s assessment that RAN2 should make the decision on either of both DCI and MAC CE should be used for cell switching command. Also, UE- initiate dynamic cell switching feature design should be RAN2 discussion. Therefore, we suggest to postpone the discussion of the proposal in this meeting. | As mentioned in the FL note, I have no plan to rush RAN1 to make an agreement because the proposal just says our spirit and RAN1 work can continue without explicit agreement. Let’s approve something if RAN1 can reach consensus. |
| Google | Not sure whether a command in addition to beam indication signalling is needed or not. Maybe we can wait to see more details on the command. |  |
| OPPO | Cell switch command (or handover command) shall be part of RAN2 discussion. |  |
| QC | Prefer DCI as cell switching command, which should be faster than 3ms MAC-CE command application time |  |
| Fujitsu | Support |  |
| Apple | Support FL proposal in general.  On the other hand, L1/L2 triggering CMD can be studied in RAN1 as well focusing on RAN1 perspective to provide suggestion/recommendation to RAN2. |  |
| DOCOMO | We suggest discussing this issue in RAN1 as well. The analysis and comparison of DCI and MAC CE based cell switch command is important. |  |
| Lenovo | We think the L1/L2 cell switch command should also be discussed in RAN1 and prefer DCI based design at least for the scenario that the best beam for target cell is know for source cell then the cell switch command can be send along with beam indication. |  |
| NEC | Support DCI based design where beam ID may be sent along with target cell indication. |  |
| ZTE | We understand that which signal will be used to carry cell switch command can be decided in RAN1 or at least need to RAN1 involvement. |  |
| Huawei, HiSilicon | the content of cell switching command should be determined before the container. |  |
| CMCC | We think using DCI or MAC CE for L1/L2 cell switch command can be discussed in RAN1. But the necessary information in the command should be first discussed. |  |
| CATT | Agree with FL’s assessment that RAN2 should make the final decision on either of DCI and MAC CE. RAN1 can first discuss the content of cell switching command from RAN1’s point of view. |  |
| vivo | We think the L1/L2 cell switch command should also be discussed in RAN1. But before the discussion, the scenarios of L1/L2 Mobility should be determined by RAN2. Since for different scenarios, the information included in the cell switch command is different. Therefore, we suggest to postpone this discussion until the scenarios is determined completely. |  |
| Ericsson | If we are aiming for an agreement, we propose a shorter version:   * + Interested companies are encouraged to perform technical analysis of the cell switch commnd from a RAN1 point of view, e.g.     - Necessary information included in the command, which is relevant for RAN1 discussion     - Necessary number of bits for the information     - L1 impact or concern to use DCI or MAC CE for L1/L2 cell switch command |  |
| Nokia | Agree with FL’s assessment |  |
| InterDigital | Agree with FL’s assessment. |  |
| Samsung | This has a strong dependence on RAN2, so we should wait for some guidance from RAN2 |  |
| Futurewei | In principle support FL’s proposal. We agree that RAN1 can discuss and determine the the “RAN1 relevant” information in cell switch command from RAN1 perspective. |  |
| Intel | We need not make an agreement about what RAN2 may decide. RAN1 can compare MAC-CE vs DCI based cell-switch command and if necessary, provide input to RAN2. It is better to have this discussion in RAN1. We think Ericsson’s version is more suitable. |  |

##### [FL observation]

While most of the companies agree that the final decision of the container should be made in RAN2, RAN1 involvement is necessary especially for the information included the command. FL believes that the companies are aligned in terms of what to do. FL thinks the proposal by Ericsson would be sufficient for now. Note that FL sees no strong necessity to approve this proposal if companies have common understanding. This proposal will be handled with low priority in this meeting.

##### [FL proposal 4-1-v2]

* ~~From RAN1 point of view, both DCI and MAC CE based L1/L2 cell switch command can be considered, and it is expected that RAN2 will make the final decision on which one to employ.~~
  + Interested companies are encouraged to perform technical analysis of the cell switch command from a RAN1 point of view, e.g.
    - Necessary information included in the command, which is relevant for RAN1 discussion
    - Necessary number of bits for the information
    - L1 impact or concern to use DCI or MAC CE for L1/L2 cell switch command
  + ~~An LS can be sent to RAN2, as necessary~~
* ~~The discussion on UE-initiated dynamic cell switch will be held in RAN2 first. RAN1 discussion can be started after receiving explicit indication from RAN2.~~
* *FL Note: FL doesn’t see a strong necessity to make any agreement/conclusion for this proposal at this meeting while some email discussion is expected in this meeting. The result of the email discussion will be used as a reference for RAN1#111.*
* *FL note: this issue is a high priority issue, but should be led by RAN2 and RAN1 can focus on RAN1 relevant issues*

##### [Discussion on proposal 4-1-v2]

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 3-2-v2 | Response from FL |
| Xiaomi | We have concern on DCI based cell switch command.  More signalling is required for DCI based dynamic switching if the beam of target cell needs to be included in switch command. Because TCI state should be activated by MAC CE before indicated by DCI. For DCI based indication, additional MAC CE is needed to activate TCI states before switch command. | Technical discussion can be started from the next meeting. Please focus on the flamework at this meeting. |
| Fujitsu | Support. |  |
| Spreadtrum | We support the proposal, and think RAN2 can take responsibility for HO cmd. |  |
| Huawei, Hisilicon | Support |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## Preparation for handover before reception of cell switch command

##### [Summary of contributions]

* Based on the discussion on time chart in RAN2, companies have proposed their own view which part of UE procedures, i.e. DL Synchronization, UL synchronization and TRS tracking and CSI acquisition, can be performed before cell switch command.
  + For DL synchronization
    - the UE should acquire the DL synchronization before processing the handover command, which can be achieved by storing QCL properties (when measurement is performed) for RSs for a certain period.
    - TCI states for target cell can be activated before the command
  + For UL synchronization
    - Should be discussed in another AI, 9.12.2
  + For TRS tracking and CSI acquisition
    - TRS tracking (obtaining QCL-TypeA RS) and CSI measurement for potential target cell(s) should be performed before handover, or can be triggered by cell switch command.
    - If so, RAN1 needs to discuss how to configure the necessary parameters for the target cells and how to active it.
* There is a proposal that discussion on potential L1 signaling design and enhancements on L1 measurement/reporting related to dynamic serving cell switch should be deprioritized till further RAN2 inputs are provided.

##### [FL observation]

Despite of the companies’ proposals in this meeting, FL thinks the proposals from the companies are based on the “ongoing RAN2 discussion”, and RAN2 has not concluded yet which procedure should/can be done before the command. While RAN1 spec impact is foreseen, RAN1 should wait for the formal input from RAN2 regarding their final decision on what is the expected time chart achieved by Rel-18 L1/L2 mobility.

##### [FL proposal 5-1-v1]

* RAN1 to further study the potential RAN1 enhancements and spec impact to perform the following procedures prior to the reception of L1/L2 cell switch command aiming at the reduction of handover delay / interruption
  + DL synchronization for potential target cell(s)
  + TRS tracking for potential target cell(s)
  + CSI acquisition for potential target cell(s)
  + Note: Uplink synchronization aspect will not be discussed under this A.I.
* Detailed discussion will be commenced after receiving RAN2 LS.
* *FL note: FL doesn’t see a strong necessity to make any agreement/conclusion for this proposal at this meeting while some email discussion is expected in this meeting. The result of the email discussion will be used as a reference for RAN1#111.*
* *FL note: this issue is a high priority issue*

##### [Discussion on proposal 5-1-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 5-1-v1 | Response from FL |
| MediaTek | Agree with FL’s assessment that which procedure should be considered before cell switch command should be determined in RAN2. Therefore, we also prefer to wait for RAN2 decision on this topic and deprioritize the discussion in this meeting. |  |
| Google | These look to be implementation related aspects. | It depends. I think RAN1 needs more analysis on the RAN1 spec impact. |
| QC | Suggest to discuss for activated and deactivated potential target cell(s) separately. For example, all those can be performed today if potential target cell is activated Scell. Otherwise, at least CSI report for deactivated cell is not allowed now.  RAN1 to further study the potential RAN1 enhancements and spec impact to perform the following procedures prior to the reception of L1/L2 cell switch command aiming at the reduction of handover delay / interruption, for activated and deactivated potential target cell(s), respectively | OK, let’s modify it in the next revision. |
| Fujitsu | Support |  |
| Apple | Support |  |
| DOCOMO | Suggest adding following bullet for further study.   * + Activation of TCI states for potential target cell(s) | OK, let’s modify it in the next revision. |
| Lenovo | Support. |  |
| New H3C | Support |  |
| NEC | Support |  |
| ZTE | Share the same view with DOCOMO, we also need to further consider activation of TCI states for candidate cell and/or activation of candidate cells. |  |
| Huawei, HiSilicon | support |  |
| CMCC | Support. We also agree to study activation of TCI states for target cells. |  |
| CATT | Support and also fine with DOCOMO’s suggestion. |  |
| ZTE | Share the same view with DOCOMO, we also need to further consider activation of TCI states for candidate cell and/or activation of candidate cells. |  |
| Ericsson | Support the FL proposal. Adding details on activated cells and TCI states is premature in our view. | I think this is for further study. Hence, I see this addition is not so critical, but OK to address your concern. |
| Nokia | Support |  |
| InterDigital | Support |  |
| Samsung | Support in principle |  |
| Futurewei | Support FL’s proposal that RAN1 can study and determine the necessary pre-configuration parameters for L1 operations of L1/L2 mobility. |  |
| Intel | Support in principle |  |

##### [FL observation]

Most of the companies are OK with the FL direction. It is also proposed to add a missing proposal while one company thinks it is premature. Overall, FL would like to propose the following update. Please note that this proposal is not so urgent given the dependency on RAN2 discussion, hence it will be treated as low priority issue.

##### [FL proposal 5-1-v2]

* RAN1 to further study the potential RAN1 enhancements and spec impact to perform the following procedures prior to the reception of L1/L2 cell switch command aiming at the reduction of handover delay / interruption, for activated and deactivated potential target cell(s), respectively
  + DL synchronization for potential target cell(s)
  + TRS tracking for potential target cell(s)
  + CSI acquisition for potential target cell(s)
  + Activation of TCI states for potential target cell(s), if feasible
  + Note: Uplink synchronization aspect will not be discussed under this A.I.
* Detailed discussion will be commenced after receiving RAN2 LS.
* *FL note: FL doesn’t see a strong necessity to make any agreement/conclusion for this proposal at this meeting while some email discussion is expected in this meeting. The result of the email discussion will be used as a reference for RAN1#111.*
* *FL note: this issue is a high priority issue*

##### [Discussion on proposal 5-1-v2]

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 3-2-v2 | Response from FL |
| Xiaomi | Support FL proposal 5-1-v2 |  |
| vivo | We think the definition of activated and deactivated potential target cell(s) is not clear and should be further clarified. Does it have the same definition as that in R17 ICBM, that the candidate cell associated with activated TCI state(s) is activated candidate cell? | I tend to agree with vivo, but I’m afraid that it would not be so easy to make a clarification.  My suggestion is to simply remove the concerning text. It should be fine to everyone because it just keep the door open. Hope QC is OK. |
| Fujitsu | Support in principle. It is suggested to remove “for activated and deactivated potential target cell(s), respectively”. From our understanding, “activated” and “deactivated” potential target cells have not been defined. It seems that companies have different understanding. “Activated” and “deactivated” can be discussed later. | See my comment to vivo |
| Huawei，HiSilicon | We share similar view as vivo and Fujitsu. The activated and deactivated is not clear. Maybe we can unify the term as “candidate target cell” as in RAN2 discussion or “candidate cell” as in section 5.1 |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## Other topics

### [Closed] BFR for Rel-18 L1/L2 mobility

##### [Summary of contributions]

* Two companies propose enhancements for BFR in conjunction with Rel-18 L1/L2 mobility, which is to choose non-serving cell as beam failure recovery.
  + Support the UE updates the beam for channels including both dedicated and non-dedicated channels based on the newly reported beam requiring serving cell change after 28+X symbols after the UE receives the BFR response
    - X is the delay for serving cell change
  + Support beam failure recovery on resources of non-serving cell.

##### [FL observation]

BFR is not clearly described in the WID, and this enhancement is proposed by two companies in this meeting. Thus, FL would encourage proponents and interested companies to have further assessments until RAN#111, and come back based on companies’ contribution, if necessary, even though WID revision may be required for RAN1 work.

##### [FL proposal 6-1-v1]

* Companies are encouraged to further study the necessity of BFR enhancements in conjunction with Rel-18 L1/L2 mobility. The discussion can be held in the future RAN1 meetings based on companies’ contribution.
* *FL note: this issue is a low priority issue at least in this meeting*

##### [Discussion on proposal 6-1-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 6-1-v1 | Response from FL |
| Google | BFR is an important aspect for beam management, which is also part of ICBM. We failed to see any reason to preclude it. | “Not mentioned in the WID” sometimes be a good justification for the opponents. Of course, the situation can be changed if many companies want to do so. And unfortunately, I would say the number of interested companies are not enough at this meeting. |
| QC | Fine to discuss BFR later |  |
| Fujitsu | Agree to discuss it later |  |
| Apple | Fine to progress first on main component of this WI to enable L1/L2-based inter-cell mobility and then discuss the potential BFR for target cell. |  |
| DOCOMO | Lower priority than other issues. |  |
| Lenovo | Agree with FL assessment. |  |
| New H3C | Support |  |
| ZTE | Agree on low priority for this issue. |  |
| LG | Agree with FL’s assessment |  |
| CATT | Agree with FL’s assessment |  |
| vivo | We share similar view with DOCOMO. |  |
| Ericsson | Low priority. No need for any agreement |  |
| Nokia | We support BFR to non-serving cell as we think that this is a valid scenario.  Since in L1/L2 mobility the UE has already the configurations of the target (i.e., non-serving) cells it may perform BFR not only to the serving cell but also to one of non-serving ones if they are more suitable (compared to the serving) to do so. We believe that BFR to serving and non-serving cells can also take place simultaneously in one BFR period in order to be more efficient.  We agree however that this is a low priority topic to be dealt with in this meeting and it could be further discussed in the following ones. |  |
| InterDigital | We support enhancement of BFR to non-serving cell since it can greatly improve robustness. Ok to discuss a bit later. |  |
| Samsung | This can be consider after progress has been made omn the basic design |  |
| Futurewei | Agree with FL’s assessment: Agree with FL that the issue of BFR enhancements is low priority. |  |
| Intel | Lower priority than main L1/L2 mobility framework |  |

##### [FL observation]

FL believes the input from companies are valuable and helpful for further discussion. Given the situation, it is clear the companies are open for BFR issue (even though many thinks this is a low priority issue), and companies can trigger the discussion by their contribution in the future meeting.

With this understanding, FL would like to close this section without capturing something in the minute.

### [Closed] Interaction between inter-cell mTRP and L1/L2 mobility

##### [Summary of contributions]

One company points out the interaction between Rel-17 ICBM and Rel-18 L1/L2 handover, and the potential scenarios are shown in their contribution (see section 2.4 of R1-2208500). More concretely, Rel-17 ICBM can be operated before L1/L2 mobility, and inter-cell mTRP can also be activated right after the mobility. R1-2208500 proposes to clarify the possible scenario(s).

##### [FL observation]

Even though the proponent company propose to study the scenario in R1-2208500 first, FL wonders if the scenarios listed in this contribution is the major use cases to be addressed in this WI (in other word, this discussion is essential to realize Rel-18 L1/L2 mobility). Interested companies are encouraged to review section 2.4 of R1-2208500, and input their contributions in the next meetings, as necessary.

##### [FL proposal 6-2-v1]

* Interested companies to review section 2.4 of R1-2208500 and bring a contribution in the future RAN1 meetings.
* *FL note: this issue is a low priority issue at least in this meeting*

##### [Discussion on proposal 6-2-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 6-2-v1 | Response from FL |
| QC | Does this mean RAN1 will decide and send LS to RAN2 on the decision? If so, better clarify in the proposal, e.g. LS will be sent to RAN2 with RAN1 decision | Sending LS is the second step discussion. At this moment, it is not clear if companies are interested in this discussion, and that’s why I didn’t express anything about LS. Let’s see companies opinion first. |
| Ericsson | We do not see that we need any agreement for this. |  |
| Nokia | We would like to clarify again that Rel-17 ICBM is not pre-requisite for L1/L2 inter-cell mobility; however, it would be good if handover can work for both types of UEs, i.e., UEs with Rel-17 ICBM operation and UEs not in Rel-17 ICBM operation. Also, after handover, the target scenario can be either an ICBM or non-ICBM. RAN1 should strive for a common framework which can allow all these scenarios. |  |
| Intel | We do not see why we need to have this agreement |  |
|  |  |  |
|  |  |  |
|  |  |  |

##### [FL observation]

It seems only a few companies are interested in this topic. It is encouraged for the interested companies to have more offline discussion. The next discussion can be started based on the companies’ contribution with more support.

With this understanding, FL would like to close this section without capturing something in the minute.

### [Closed] Measurement requirements

##### [Summary of contributions]

An issue is raised by R1-2208679 regarding the measurement requirement, which mentions that the overall process can be accelerated by applying the same requirements for intra-frequency and inter-frequency measurement:

* The intra-frequency measurements used for L1/L2 mobility have the same requirements as the intra-frequency measurements
* The inter-frequency measurements used for L1/L2 mobility have the same requirements as the inter-frequency measurements.

Otherwise, the measurements could not be performed at the same time. Then, it is proposed to send an LS to RAN4 describing the accuracy requirements for the measurements used for L1/L2 mobility.

##### [FL observation]

Given the fact that inter-frequency mobility scenario has not been agreed in RAN2, it would be premature to discuss this issue. In addition, it is not clear why this discussion is triggered in RAN1. RAN2 (as a leading WG) or RAN4 should discuss this issue directly to avoid the overhead.

##### [FL proposal 6-3-v1]

* Interested companies are encouraged to bring intra-frequency and inter-frequency measurement requirement issue to RAN2 and/or RAN4.
* *FL note: this is a low priority issue at least for RAN1 from FL perspective.*

##### [Discussion on proposal 6-3-v1]

Please input your view in the table below:

|  |  |  |
| --- | --- | --- |
| Company | Comment to proposal 6-3-v1 | Response from FL |
| QC | Fine for leave to RAN2/4. Some issues can be triggered by RAN1 via LS, e.g. scheduling restriction/rate matching related issues |  |
| Apple | These should be handled by RAN4 and RAN2 unless these would result in different designs in RAN1. |  |
| Nokia | Measurement requirement issues should be handled by RAN4. |  |
| Intel | Seems to be a RAN4 issue. |  |
|  |  |  |
|  |  |  |
|  |  |  |

##### [FL observation]

It seems that companies have a common understanding that this issue can be discussed in RAN4 directly, or RAN2 (as the leading WG).

With this understanding, FL would like to close this section without capturing something in the minute.

# Annex

# WID in RP-222332

The detailed objective of this work item is captured below:

1. To specify mechanism and procedures of L1/L2 based inter-cell mobility for mobility latency reduction:

* Configuration and maintenance for multiple candidate cells to allow fast application of configurations for candidate cells [RAN2, RAN3]
* Dynamic switch mechanism among candidate serving cells (including SpCell and SCell) for the potential applicable scenarios based on L1/L2 signalling [RAN2, RAN1]
* L1 enhancements for inter-cell beam management, including L1 measurement and reporting, and beam indication [RAN1, RAN2]
  + *Note 1: Early RAN2 involvement is necessary, including the possibility of further clarifying the interaction between this bullet with the previous bullet*
* Timing Advance management [RAN1, RAN2]
* CU-DU interface signaling to support L1/L2 mobility, if needed [RAN3]

*Note 2: FR2 specific enhancements are not precluded, if any.*

*Note 3: The procedure of L1/L2 based inter-cell mobility are applicable to the following scenarios:*

* + - *Standalone, CA and NR-DC case with serving cell change within one CG*
    - *Intra-DU case and intra-CU inter-DU case (applicable for Standalone and CA: no new RAN interfaces are expected)*
    - *Both intra-frequency and inter-frequency*
    - *Both FR1 and FR2*
    - *Source and target cells may be synchronized or non-synchronized*

1. To specify mechanism and procedures of NR-DC with selective activation of the cell groups (at least for SCG) via L3 enhancements:

* To allow subsequent cell group change after changing CG without reconfiguration and re-initiation of CPC/CPA [RAN2, RAN3, RAN4]

*Note 4: A harmonized* RRC modelling approach for objectives 1 and 2 could be considered to minimize the workload in RAN2.

1. To specify data forwarding optimizations for CHO including target MCG and target SCG in NR-DC [RAN3].
2. To specify CHO including target MCG and candidate SCGs for CPC/CPA in NR-DC [RAN3, RAN2]

* CHO including target MCG and target SCG is used as the baseline

1. To specify RRM core requirements for the following, as necessary [RAN4]:

* L1/L2-based inter-cell mobility
* Enhanced CHO configurations addressed by this WI

1. To specify RF requirements to cover inter-frequency L1/L2-based mobility, as necessary [RAN4].
2. To study the following, with completion targeted by RAN#98 meeting [RAN4]:

* The impact of FR2 RRM mobility measurement acquisition and reporting on FR2 SCell/SCG setup/resume delay for a UE connecting from idle/inactive mode.
* The level of feasible improvement in FR2 SCell/SCG setup delay from defining new UE measurement procedures and RRM core requirements, and whether additional information from the network would help the UE to perform those measurements effectively. The following sequence of events should be assumed.
  + - The UE initiates and performs improved measurements when it requests RRC connection setup/resume.
    - After acquiring those improved measurements, the UE subsequently reports those measurements to the network to support SCell/SCG setup.

# TU allocation

