3GPP TSG-RAN WG2 Meeting #109bis-e Draft-R2-2003928

Online, April 20th – 30th , 2020

**Agenda item: 7.1.8**

**Source: Qualcomm**

**Title: Report for [AT109bis-e][413][eMTC] Mobility enhancements - Open issues (Qualcomm)**

**Document for: Report**

# 1 Scope of the email discussion

This document contains the summary of the documents in Agenda item 7.1.8 regarding two issues (1) early implementable of Relaxed serving cell measurement when using WUS from Rel-15 [1] and (2) RSS [2], [3], [4] as per below email discussion:

* [AT109bis-e][413][eMTC] Mobility enhancements - Open issues (Qualcomm)

Scope: Remaining open issues on mobility enhancements including [R2-2003188](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003188.zip).

Intended outcome: Report including a list of proposals categorized as agreeable, need further discussion etc.. The outcome can be provided in R2-2003928.

Deadline: Friday, Apr. 24th 10:00 UTC

# 2 Discussion

## Early implementation of Relaxed serving cell measurement

Relaxed serving cell measurement when using WUS was discussed in Rel-15 and it was introduced for NB-IoT from Rel-15 but it could not be concluded for eMTC due to lack of time. As clarified in [1], it is introduced from Release 16. This feature has no UE capability indication and is linked to support for WUS. [1] proposes that a Release 15 UE supporting WUS can also make use of this power saving feature provided network broadcasts *numDRX-CyclesRelaxed-r16* and the UE meets the conditions specified for relaxed serving cell measurement by RAN4 in TS 36.133.

**Question 1: Do companies see any issue in allowing early implementation of relaxed serving cell measurement (i.e., *numDRX-CyclesRelaxed-r16*) when WUS is used from Rel-15?**

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| **Company** | **Yes/No** | **Comment** |
| Qualcomm | No | As mentioned above, this feature has no UE capability indication and is linked to support for WUS. Therefore, from UE implementation point of view, there is no need to restrict support of this feature to be only from Release 16. A Release 15 UE supporting WUS can make use of this power saving feature provided network broadcasts *numDRX-CyclesRelaxed-r16*. |
| Huawei, HiSilicon |  | We do not see any particular problem but wonder what the motivation is given that the new synchronisation signal introduced in Rel-15 offers better power saving performance. |
| Ericsson | No | [Merged]  RSS and WUS can be considered two separate features which have their own benefits. WUS may have limited synchronisation option up to the max number of DRX cycle length and UE comping out from deep sleep may prefer RSS and afterwards may use WUS. |
| ZTE | No | Tend to agree with UE vendor’s understanding on the feasibility of early implementation of *numDRX-CyclesRelaxed-r16*. |

**Question 2: If answer to Question 1 is NO, please elaborate how to realize the early implementation of relaxed serving cell measurement (i.e., *numDRX-CyclesRelaxed-r16*) for Rel-15 UEs?**

Option A): Update the early implementable table in TS 36.331 (as proposed in [1])

Option B): TEI-15 CR

Option C): Any other

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| **Company** | **Which option** | **Comment** |
| Qualcomm | Option A | This option is simple, and change is only in Table G-1: List of CRs Containing Early Implementable Features and Corrections. |
| Huawei, HiSilicon |  | No clear preference right now, however should point out that usually an entire CR is early implementable, it is not clear we can handle one small part of a WI CR as early implementable without any problem e.g. for RAN5 and for this reason the TEI15 CR might be a better option even though it does imply more changes. |
| Ericsson | B | [Merged]  Yes, TEI-15 could be good for better visibility/traceability. |
| ZTE | Option B | Has similar concern as HW. We prefer option B) to provide a clear R15 CR (we assume there would have ASN.1 impacts). Moreover, we may need to check whether RAN4 changes in R15 are needed. |

Summary:

All four companies see no issue in allowing early implementation of relaxed serving cell measurement (i.e., numDRX-CyclesRelaxed-r16) when WUS is used from Rel-15. However, majority think TEI-15 CR is a better option. Rapporteur thinks how to provide the Rel-15 TEI CR to use Rel-16 feature needs to be discussed as it has impact on signalling and a LS needs to be sent to RAN4.

1. Early implementation of relaxed serving cell measurement by Rel-15 UEs when using WUS is permitted.
2. RAN2 discuss how to provide CR to permit relaxed serving cell measurements by Rel-15 UEs when using WUS.

## RSS

For RSS, email discussion was concluded with a text proposal and a proposal to further discuss whether dedicated signalling is needed for the configuration of RSS in [2]. In RAN2#109bis-e meeting, it is agreed to take the text proposal in [3] as baseline.

According to RAN1 parameter list [5], if a neighbour cell list is not present in neighbour cell list, then UE assumes the RSS power bias is same as that used for serving cell or camped on cell. The UE can also assume same when neighbour cell list is absent from SIB4 or SIB5 (i.e., NCL is not present so a neighbour cell is NOT present in NCL).

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| RSS NCL power bias | Power bias in dB relative to CRS's q\_offset of cells in the neighbor cell list for CE mode A/B in RRC\_IDLE and RRC\_CONNECTED and where one value indicates that RSS is not used for that neighbor cell. | -6, -3, 0, 3, 6, 9, 12, rssNotUsed | Cell specific |

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| rss-measurement-non-NCL-enabled | A one bit indicator indicating whether RSS of neighbour cells that are NOT in the Neighbour Cell List can be used for measurements for CE mode A/B in RRC\_IDLE and RRC\_CONNECTED. When indicated as Enabled, the UE assumes that the RSS power bias is the same as that used for the serving cell or the camped on cell, for all neighbour cells that are NOT in the Neighbour Cell List. | Enabled | Cell specific |

However, there is proposal whether to use default value of zero if a neighbour cell is missing in neighbour cell list.

**Question 3: For all neighbour cells that are NOT in the Neighbour Cell List (NCL), what value of RSS power bias UE assumes?**

Option A) Follow what RAN1 has indicated (i.e., assume that the RSS power bias is the same as that used for the serving cell or the camped on cell).

Option B) use default value 0.

Option C) *rss-MeasPowerBias-r16* is provided as default value in SIB2

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| **Company** | **Which option** | **Comments** |
| Qualcomm | Option A | RAN2 does not need to define new value. We should simply follow what RAN1 has indicated. |
| Huawei, HiSilicon | Option A |  |
| Ericsson | Option A/C | Serving cell parameter for this has to be added and this will be in SIB2 similar to other Rel-15 existing parameter.  The only thing to note is that serving cell power offset is available also in Rel-15.  powerBoost-r15 ENUMERATED {dB0, dB3, dB4dot8, dB6},  But this may not be the value to be used and the new parameter below should be used.  rss-MeasPowerBias-r16 ENUMERATED {dB-6, dB-3, dB0, dB3, dB6, dB9, dB12, rssNotUsed}  This should be added in SIB2. |
| ZTE | Option A |  |

Summary:

All four companies agree that as RAN1 indicated UE can assume that the RSS power bias is the same as that used for the serving cell or the camped on cell for all neighbour cells that are NOT in the Neighbour Cell List. However, one company thinks it is better to provide rss-MeasPowerBias-r16 as default value in SIB2.

Based on agreeable views and based on what RAN1 has specified in the latest RAN1 parameter list, following is proposed.

1. UE assumes that the RSS power bias is the same as that used for the serving cell or the camped on cell for all neighbour cells that are NOT in the Neighbour Cell List.

To apply the RSS power bias of a neighbour cell, UE needs to know the q\_offset value of the neighbour cell. The value of q\_offset is present in NCL in SIB. However, RSS power bias (*rss-MeasPowerBias-r16*) is OPTIONAL in the NCL and neighbour cell list may be present, for example in SIB4 and SIB5, as per proposed text [3] but the RSS power bias may be absent.

**Question 4: If a neighbour cell is in the Neighbour Cell List (NCL) but RSS power bias is NOT in the NCL, what value of RSS power bias UE assumes?**

Option A) same as that used for the serving cell or the camped on cell

Option B) use default value 0.

Option C) *rss-MeasPowerBias-r16* is provided as default value in SIB2 (as captured in [3])

Option D) rssNotUsed

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| **Company** | **Which option** | **Comments** |
| Qualcomm | Option B | We just cannot assume *rss-MeasPowerBias-r16* is mandatorily present if NLC is present due to signalling overhead.  We think option A) also works. However, if q\_offset of the neighbour cell is present, power bias of value 0 can be used.  Therefore, our understanding is *rss-MeasPowerBias-r16* does not need to be provided in SIB2 and signalling overhead can be reduced. |
| Huawei, HiSilicon | Option D | The default value, if not signalled, should be as per legacy – i.e. not used. |
| Ericsson | D | If RSS is to be used, then ofcourse the parameter will be provided.  The challenge is more when NCL is not present.  When there is NCL, and if deployment wants to use RSS; the parameter will be provided as the signalling cost is not high, |
| ZTE | / | We agree with QC that *rss-MeasPowerBias-r16* does not need to be provided in SIB2.  After further thinking, we assume network would not always provide all the list for *rss-MeasPowerBias* in SIB4/SIB5 if kind of default value is applicable for some cells. This is for saving signalling overhead. In order to handle such case, it can just follow legacy process based on parameter type. For example, in SIB4 or SIB5, the *rss-MeasPowerBias* can be defined as Need OP and the UE could use the default value specified in field description if the parameter is absent. We are fine with default value to be either 0 or *rssNotUsed*. |

Summary:

Two companies think that if power bias value is absent for a neighbour cell in NCL, default value can be used. Therefore, rss-MeasPowerBias is not needed in SIB2. One company additionally thinks either way is fine. Whereas two companies think that it means RSS should not be used in that neighbour cell.

Based on the majority views, following is proposed.

1. If a neighbour cell is in the Neighbour Cell List (NCL) but RSS power bias is NOT in the NCL, UE assumes RSS-based measurement is not used for that neighbour cell.
2. Remove *rss-MeasPowerBias-r16* from SIB2 (common configuration for SIB) from the text proposal.

RAN2 has received the latest feature list from RAN1, see [5]. Specially the UE may need to meet certain conditions to use of RSS in connected mode, for example, the RSS of the neighbour cell may be in different narrowband than the unicast narrowband. Also, the configured measurement gap may not work for neighbour cells as the RSS occasion may not fall in the measurement gap. Reconfiguring measurement gap to align with RSS occasion for one neighbour cell may not work for other neighbour cells and can interfere with existing tasks that UE is required to do to meet RRM requirements. Therefore, there is high probability that UE may not benefit much from RSS in RRC\_CONNECTED. Currently this is still work in progress in RAN4. Furthermore, according to latest RAN1 feature list [5], a separate UE capability may be needed for IDLE mode and RRC\_CONNECTED mode. It is up to RAN4 to decide whether eNB needs to know UE supports RSS-based measurement and whether RSS-based measurement is mandatory.

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| Feature group | Prerequisite feature groups | Need for the eNB to know if the feature is supported | Need of FDD/TDD differentiation | Capability interpretation for mixture of FDD/TDD | Note | Mandatory/Optional |
| RSS-based measurement improvement | Rel-15 RSS | Up to RAN4 | Yes | N/A | It is up to RAN2/RAN4 whether to have separate capabilities for Idle and Connected.  FFS: Whether it might also be relevant to consider separate capabilities for CE mode A and B  FFS: Consider removing this row since it will be part of the RAN4 UE feature list. | Up to RAN4 |

**Question 5: Should RAN2 wait RAN4 progress to capture UE capability signalling to use RSS in RRC\_IDLE and RRC\_CONNECTED?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes | We think we should wait RAN4 progress at least to know whether the feature is mandatory or optional. Also, RAN4 needs to decide whether eNB needs to know UE supports RSS-based measurement as highlighted by RAN1 in the provided UE feature list. |
| Huawei, HiSilicon | Yes | We are fine to wait otherwise we will just waste time discussing. |
| Ericsson | Yes/No | It is ok to wait for RAN4, but clearly as connected mode is in signalling scope from RAN4 point of view. We should at least have some draft TP for this. |
| ZTE | / | We learn that RAN4 has agreed for CONNECTED mode measurements, RSS power offset with respect to CRS is equal to or greater than 0 dB. Measurement gap or Measurement delays in CONNECTED is still under discussion. So we assume RSS measurement for CONNECTED would be supported, even from RAN4 perspective (we think RAN1 has already indicated support).  Therefore, we agree with Ericsson that we should at least have some RAN2 draft TP for this, not just pending to the last meeting. |

Summary:

Three companies are fine to wait for further progress in the RAN4 before capturing the UE capability signalling for both RRC\_IDLE and RRC\_CONNECTED. Two companies think that RAN2 should also capture the text proposal while waiting RAN4 progress.

Rapporteur thinks that RAN4 will inform the decision on whether UE capability signalling is needed as per request indicated in highlight by RAN1 feature list. Based on majority view, following is proposed.

1. RAN2 wait RAN4 progress to capture UE capability signalling to use RSS in RRC\_IDLE and RRC\_CONNECTED.

In addition, the RSS configuration of the neighbour cell has to be provided in SIB as indicated by RAN1. If UE has acquired the RSS configuration from the SIB, then it can use that information when in RRC\_CONNECTED. This is already clear in the field description provided in [3] and, if needed, additional clarification can be added. In addition, if the dedicated signalling is missing, UE has to use the RSS parameters provided in SIB anyway. So, there is no guarantee that UE in RRC\_CONNECTED does not have to use RSS parameters provided in SIB. UE also needs q\_offset of each neighbour cell to apply the RSS power bias which significantly increases the dedicated signalling overhead.

It is possible that UE may declare RLF and perform RRC re-establishment to a target cell without acquiring SIB4 and SIB5 of the target cell. It is possible that network may handover the UE in RRC\_CONNECTED to a target cell. The UE may not acquire the SIB4 and SIB5 of the target cell in RRC\_CONNECTED since the UE may be provided with SIB1 and SIB2 of the target cell in handover command message. In this case, a neighbour cell may not be in the stored NCL but it may be present in NCL broadcast by the target cell. What UE assumes in this case needs to be clarified. In addition, RSS may be collocated with source cell (i.e., RSS information is not present in source cell) and the UE needs to know whether it is collocated with the target cell.

**Question 6: In RRC\_CONNECTED mode, how does UE update the neighbour cell list (NCL) for a new target cell?**

Option A) RSS configuration for the target cell are provided in HO command message.

Option B) RSS information for intra-frequency and inter-frequency neighbour cell list is provided in SIB2 instead of SIB4 and SIB5.

Option C) RSS information is provided as part of a list of measurement objects in RRC reconfiguration message [4].

Option D) Do nothing. If UE has NOT stored the RSS power bias of a neighbour cell, the UE behaviour can be same as if the neighbour cell is not present in NCL. An indication whether RSS is collocated or not is provided to UE via SIB2.

Option E) Wait for further RAN4 progress

Option F) Any other

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| **Company** | **Which option** | **Please elaborate the solution** |
| Qualcomm | Option E | It is not clear what are the conditions UE needs to meet to use RSS when in RRC\_CONNECTED. The UE may not benefit from RSS of the neighbour cell even if it has all the RSS parameters of that neighbour cell. For example, whether RSS-based measurement is applicable in case:   1. MPDCCH monitoring unicast narrowband is not same as RSS narrowband of the neighbour cell. 2. RSS occasion of a neighbour cell is out of the configured measurement gap. 3. RSS power offset with respect to CRS of the neighbour cell is less than 0 dB which does not meet accuracy requirements.   The RSS information of a cell is not expected to change. There is also NO motivation to provide the same RSS information via SIB and dedicated signalling.  In our view, Option D) is also enough. If UE has no any stored RSS information of a neighbour cell, it does not need to use RSS-based measurement in that cell. If needed, additional clarification can be added in SIB4/5 that RSS information is used both in RRC\_IDLE and RRC\_CONNECTED.  Given the question on use of RSS in RRC\_CONNECTED and its impact on UE, we would like to wait RAN4 progress to decide whether dedicated signalling is necessary for RSS configuration. |
| Huawei, HiSilicon | Option E | We need to wait for RAN4, we may need a combination of options A/C and D. |
| Ericsson | C | The conditions and rules are for the RAN4 to specify; we simply need to provide signalling (ASN.1); Similar to other existing measurement configuration; the RSS measurement configuration can be also added.  We should not make it complicated and consider tons of combinations.  Option C is fine. |
| ZTE | Option C | We agree with Ericsson that the conditions and rules are for the RAN4 to specify and RAN4 can guarantee the required performance for RSS measurement in CONNECTED. So we are not clear why company says the UE may not benefit from RSS of the neighbour cell even if it has all the RSS parameters of that neighbour cell.  We are also confused by the comments that “*the RSS information of a cell is not expected to change, there is also NO motivation to provide the same RSS information via SIB and dedicated signalling.*” Generally, we assume the cells for measurement in RRC\_CONNECTED would not have to be same as the neighbour cells for measurement in RRC\_IDLE. In another word, they are possible different. Therefore, the information in SIB4/SIB5 may no longer be applicable.  Moreover, even we can allow RSS information in SIB4/SIB5 is used both in RRC\_IDLE and RRC\_CONNECTED, in order to make it feasible for UE to continue RSS measurement in CONNECTED after UE moves to other cell, the SIB4/SIB5 need to be added into HO command (the motivation for option A)?). We think such changes are big and may cause much unnecessary information delivery.  As we assume RSS measurement in RRC\_CONNECTED is mainly used for cell measurement but not for cell demodulation (e.g., interference mitigation), we think option C) is more suitable. |

Two companies agree to wait further RAN4 progress on the use of RSS in RRC\_CONNECTED before specifying how to update NCL upon handover to new target cell. Two companies think that simply the RSS configuration should be provided as part of a list of measurement objects in RRC reconfiguration message.

Rapporteur thinks that it needs to be clear how UE makes the use of RSS in RRC\_CONNECTED after handover or RRC re-establishment to a new target cell, for example, the RSS configuration is not present in dedicated signalling, if introduced. In addition, UE capability signalling for use of RSS in RRC\_CONNECTED is needed before the RSS configuration can be provided in dedicated signalling, which is pending RAN4 decision. Since there is no majority in the views, following is proposed.

1. RAN2 wait further RAN4 progress on the use of RSS in RRC\_CONNECTED before specifying RSS signalling configuration in RRC\_CONNECTED.

**Question 7: Any other issue?**

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| **Company** | **Yes/No** | **If yes, please elaborate the issue** |
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# 3 Conclusion

Proposal 1 Early implementation of relaxed serving cell measurement by Rel-15 UEs when using WUS is permitted.

Proposal 2 RAN2 discuss how to provide CR to permit relaxed serving cell measurements by Rel-15 UEs when using WUS.

Proposal 3 UE assumes that the RSS power bias is the same as that used for the serving cell or the camped on cell for all neighbour cells that are NOT in the Neighbour Cell List.

Proposal 4 If a neighbour cell is in the Neighbour Cell List (NCL) but RSS power bias is NOT in the NCL, UE assumes RSS-based measurement is not used for that neighbour cell.

Proposal 5 Remove *rss-MeasPowerBias-r16* from SIB2 (common configuration for SIB) from the text proposal.

Proposal 6 RAN2 wait RAN4 progress to capture UE capability signalling to use RSS in RRC\_IDLE and RRC\_CONNECTED.

Proposal 7 RAN2 wait further RAN4 progress on the use of RSS in RRC\_CONNECTED before specifying RSS signalling configuration in RRC\_CONNECTED.

# 3 References

[1] R2-2003188 Permit early implementation of relaxed serving cell measurement.

[2] R2-2003141 Report on Email discussion RSS Configurations.

[3] R2-2003138 Introduction of RSS Configurations

[4] R2-2003814 Addressing FFSs for RSS configuration.

[5] R2-2002519 LS on updated Rel-16 LTE and NR parameter lists.