**3GPP TSG-RAN WG4 Meeting #104-e draft R4-2214454**

**<Electronic Meeting>, 15 ‒ 26 August, 2022**

**Title:** WF on BC in RRC\_INACTIVE and initial access

**Agenda Item:** 11.7.4

**Source: Nokia**

**Document for:** Approval

# Sub-topic 1: Rel-16 RRC\_Connected Beam Correspondence applicability to Rel-18 RRC\_INACTIVE/IA Beam Correspondence

**Way forward/Agreements:**

* There is no UL beam sweep for IA BC requirements
* At least Msg1 will be tested.
* A ~~new~~ requirement is needed for Msg1 for all UEs regardless of Rel-16 BC IEs.
	+ CMCC clarify what the new req is? spherical requirement? minimum peak EIRP or tolerance requirements?
	+ Nokia: at least our intention is requirement for Msg1. We could remove new.
	+ Qualcomm: Nokia comment is OK.
	+ CMCC: removing new is oK for us. Do we consider the tolerance requirement? I did not see any description about the tolerance.
	+ Ericssson: we would like to add at least Msg 1 it does not preclude the combinations with other metrics like RAR performance. Check the correlation between Rx and Tx beams.
	+ Qualcomm: beam correspondence tolerance is associated with UE bit-0 to do beam sweeping. The requirement on the delta is not relevant there. There is not beam sweeping requirement here, i.e., tolerance.
	+ Samsung: we just say beam correspondence is relative.
	+ Huawei: share the same view as Qualcomm and Samsung. BC requirement is OK for me. For RAR requirement, currently companies agree with requirement of Msg1.
	+ OPPO: regarding this bullet, it said requirement is needed regardless of Rel-16 BC IEs. In the later stage we will discuss the test reduction. We do not want to preclude Rel-16 BC.
	+ CMCC: for UE to reporting supporting BC without beam sweeping, it means that we totally trust UE and no requirement.
	+ Ericsson: we disagree with Huawei that RAR is FFS. We should not preclude it. The spherical coverage requirement would be relaxed and cannot guarantee the performance of BC.
	+ Apple: Similar question as Ericsson. For connected mode, we have no additional step measurement similarity of Rx and Tx. Why do we need to do it for initial stage. We are OK to keep the door open. Currently stage we not sure.
	+ ZTE: Missing part is whether there is BC in the initial access. We need to consider other metric.
	+ Sony: to CMCC, for initial access, network cannot configure UE to do beam sweeping. All the UE should support BC without sweeping. We support not to preclude RAR. Whether to check RAR depends on how to set requirement.
	+ Huawei: FFS does not preclude the RAR. We have already check UL and DL beam similarity.
	+ Ericsson: does any spherical coverage requirement guarantee the beam correspondence?
	+ Qualcomm: BC we have to talk about what is meaning of BC. It means that enough EIRP should be gotten. If checking the spatial filter, UL and DL may be different.
	+ Samsung: the similarity was discussed. After discussion we only keep EIRP. We need to stick to previous. We just use EIRP metric. At the current stage, we do not think RAR metric and similarity is reasonable.
	+ Apple: similar view as Samsung. The EIRP based requirement is sufficient. If Ericson believe the current requirement is not sufficient, it may be beyond the scope of WI.
	+ Vivo: we are not ready to accept to take EIRP as the only values in this meeting. We do not know how UE generate the rough beam.
	+ Qualcomm:
* If UEs support both IEs *beamCorrespondenceWithoutUL-BeamSweeping* and *beamCorrespondenceSSB-based-r16*, and performs IA with 4-step RACH then no new requirement is needed for Msg3
	+ OPPO against
	+ OPPO: for the Msg 3 it is premature to say whether it is needed or not. There is no consensus on it.
	+ Apple: Share the similar view as OPPO. We think the sentence is misleading.
	+ Qualcomm: the concern from companies are not automatically true.
	+ Samsung: it is a slightly misleading.
* Use PC3 as baseline for testing and requirements and handle specific values for other PC afterwards and based on the same method
* At least spherical coverage requirements will be tested for RRC\_Inactive Beam correspondence for Msg1
	+ Huawei/Xiaomi proposes RRC\_IDLE instead of RRC\_Inactive
	+ Huawei: there is related discussion on whether the requirement should be specified for both. Majority view is that RRC\_idle is OK. We can only list idle.
	+ Xiaomi: there is FFS on STD test and inactive mode test. The spherical need be test is unreasonable.
	+ Nokia: this WI name is using RRC\_idle and initial access. We should align the terms.
	+ OPPO: Echo Huawei and Xiaomi.
* Define a specific EIRP value at N% of the distribution of radiated power
	+ QC/Samsung/Sony/ZTE not agree. Existing ones reused. vivo against the existing metric. Huawei to move this to FFS.
* Discuss the value of N, e.g. N=[X]% for PC3
	+ QC/Samsung/Sony/ZTE not agree. Existing value X=50% reused. vivo against the existing metric. Huawei to move this to FFS.
* BC is defined at maximum output power. [Samsung, Sony]

Agreement:

* There is no UL beam sweep for IA BC requirements
* At least Msg1 will be tested.
* Use PC3 as baseline for testing and requirements and handle specific values for other PC afterwards and based on the same method
* BC is defined at maximum output power

**Way forward/FFS:**

* FFS: Study the relevancy of adding min peak EIRP requirements in addition with spherical coverage requirements for BC Inactive (for each of the cases: Msg1/MsgA/RA-SDT/CG-SDT)
	+ QC against, Huawei IDLE instead of Inactive.
* FFS: values for the requirements (EIRP, X%, etc)
	+ Samsung for keeping the existing X=50%
* FFS: Discuss whether BC requirements values will be the same for RA-SDT, CG-SDT and initial access (Msg1, MsgA, Msg 3), if yes should all be tested?
	+ Huawei to remove Msg3.
* FFS: Discuss whether Msg1 and Msg A should have the same requirements? If yes, should both be tested?
* FFS: BC side conditions
* FFS whether RAR reception need to be also tested to verify the similarity between Tx and Rx beams. [Sony]

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| Company | Agree/Disagree, include justification |
| Qualcomm | We are not sure we need to redefine N % . We prefer to use the N specified for connected mode. Would proponents clarify why EIRP @ N must be studied again? (Do not agree to last 2 proposed agreements)In the FFS list, why are we wanting to study the relevancy of min peak EIRP? (do not agree) |
| vivo | Before we figure out the baseline should be “rough” beam or “fine” beam and whether the beam refinement procedure is allowed during initial access, we can not agree the last 2 agreement above, and we prefer keep it open for further discussion. |
| Samsung | We agree with Qualcomm that the existing N% value of each power class should be reused, i.e. N=50% for PC3.The same comment applys to the 2nd bullet of FFS list.Besides beam correspondence test is at UE maximum output power in terms of testability, the beam correspondence requirements should also be specified at UE maximum output power. So we suggest to also capture this agreement in this WF for requirement perspective. |
| OPPO | Regarding 4th bullet:We don’t see there is agreement in 1st round that MSG3 will be specified, instead clear majority prefer only MSG1. Not clear why this MSG3 requirement are captured here as an agreement. Suggest to remove it.And also not clear how to use “performs IA with 4-step RACH” as a precondition to determine whether MSG3 requirement is needed or not in conformance testing, this is not a beforehand information. |
| HW | Regarding 5th Agreement bullet:In 1st round discussion, majority are interested in discussion on IDLE mode. Propose to change this bullet to :“At least spherical coverage requirements will be tested for RRC\_IDLE Beam correspondence for Msg1”Regarding last 2 Agreement bullets:The exact spherical requirements would depend on discussion of ‘fine’ beam and ‘rough’ beam. Propose to keep these bullets FFS.Regarding 1st FFS bullet:Same as above. Propose to replace ‘Inactive’ by ‘IDLE’Regarding 3rd FFS bullet:As per Issue 2-2-3 in 1st round discussion, Msg 3 doesn’t need further study. |
| Sony | In general, considering this is the first meeting, it would be good enough if we could agree to take the EIRP spherical coverage of msg 1 as a starting point. Therefore, we are fine to remove the last two bullets in the agreement as suggested by QC.We also support Samsung’s proposal on capturing the maximum output power. In addition, we suggest to also add a point in the WF/FFS section that RAR need to be FFS:* FFS whether RAR reception need to be also tested to verify the similarity between Tx and Rx beams.
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| CMCC | More detailed clarification is needed on the third bullet. The new requirement is spherical requirement? or new minimum peak EIRP or tolerance requirements? |
| ZTE | I would suggest to group the WF/agreements into two categories: core requirements and testsCore requirements:* There is no UL beam sweep for IA BC requirements
* ~~At least Msg1 will be tested.~~
* A new requirement is needed for Msg1 for all UEs regardless of Rel-16 BC IEs.
* If UEs support both IEs *beamCorrespondenceWithoutUL-BeamSweeping* and *beamCorrespondenceSSB-based-r16*, and performs IA with 4-step RACH then no new requirement is needed for Msg3
* ~~Use PC3 as baseline for testing and requirements and handle specific values for other PC afterwards and based on the same method~~
* ~~At least spherical coverage requirements will be tested for RRC\_Inactive Beam correspondence for Msg1~~
* Define a specific EIRP value at N% of the distribution of radiated power
* Discuss the value of N, e.g. N=[X]% for PC3

Tests:* At least Msg1 will be tested.
* Use PC3 as baseline for testing and requirements and handle specific values for other PC afterwards and based on the same method
* At least spherical coverage requirements will be tested for RRC\_Inactive Beam correspondence for Msg1

In addition, we also would like to know why percentage of each PC cannot be reused? |
| Xiaomi | Regarding 5th Agreement bulletIn another WF for BC testability, feasibility of testing UEs in Inactive mode is for further study, based on first round discussion, we have the similar view with HW, it should change Inactive mode to RRC\_IDLE. |
| Ericsson | Beam correspondence is a fundamental part of FR2. Testing this has been discussed since Rel-15. It has been argued that BC is implicitly verified by the spherical coverage test – the latter cannot be met without beam correspondence. Is this true for any spherical coverage requirement level for msg1? We note that UEs requiring beam sweeping in connected more are allowed a relaxed spherical coverage requirement. We propose to amend the WF as follows* “At least Msg1 will be tested. This does not precludc combination with other metrics like RAR performance in the test.”
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# Sub-topic 2: UE beam type and DRX implications in Rel-18 Inactive Beam Correspondence

**Way forward/Agreement:**

* The UE need not indicate support of BC without UL beam sweeping in inactive and IA. The usability of this capability is not clear at this point [Initial proposed text]

A few companies are not sure about keeping the 2nd sentence.

Alternative texts

* The UE need not indicate support of BC without UL beam sweeping in inactive and IA. [ZTE]
* The network presumes UE does not depend on UL beam sweeping functionality for beam correspondence in inactive or idle mode [Qualcomm, Verizon]
* It is assumed UE does not depend on UL beam sweeping functionality for beam correspondence in inactive or idle mode. [OPPO]
* All UE should support beam correspondence without UL beam sweeping in inactive and IA, therefore there is no need for UE to indicate the support of BC without UL beam sweeping. [Sony, CMCC]

**Proposal:**

* The UE need not indicate support of BC without UL beam sweeping in inactive and IA. [ZTE]

**Discussion:**

**Qualcomm: what is the agreement here?**

**ZTE: the original proposal is to make sure at network it does not relay on the capability reported. “Usability of this capability” is not clear**

**OPPO: this way forward is discussing the assumption and pre-condition.**

**Apple: not sure if it is needed since there is no requirement.**

**Samsung: we agreed that all the UE needs support the BC. The new agreement is dulplicated.**

**Sony: agree with Samsung. It is duplicated to the agreement in the other way forward. Capability is not clear.**

**Way forward/FFS:**

* FFS: How beam refinement may work in RRC\_INACTIVE (RA-SDT and CG-SDT) and initial access
* FFS: Discuss the impact of fine beam vs rough beam for UE UL Tx beam on the test(s)
* FFS: Discuss if the refinement is the same as Rel-16 SSB only case
* FFS: Whether the peak EIRP the same as Rel-16 SSB only case achieved.
* FFS: Discuss DRX implications on UE beam refinement and on BC accuracy

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| Company | Agree/Disagree, include justification |
| Qualcomm | Perhaps the agreement can be reworded to something like ‘The network presumes UE does not depend on UL beam sweeping functionality for beam correspondence in inactive or idle mode’ |
| OPPO | QC alternative is better, but small changes maybe: “The network presumes…” -> “It is assumed UE does not depend on UL beam sweeping functionality for beam correspondence in inactive or idle mode”Because this is not for the NW scheduling discussion, this is the assumption for requirement definition. |
| Verizon | Agree with Qualcomm! |
| Sony | An alternative way to reword the agreement to Qualcomm and OPPO’s version: to our understanding, all UE should support beam correspondence without UL beam sweeping since the network can’t configure the UE with SRS UL beam sweeping in inactive and IA, and this is the reason why it is not needed for UE indicate this to the network.We suggest an alternative wording here for clarify the agreement: “All UE should support beam correspondence without UL beam sweeping in inactive and IA, therefore there is no need for UE to indicate the support of BC without UL beam sweeping.” We also think the last part “The usability of this capability is not clear at this point” is not needed in the agreement, since the reasoning of not indicate this capability is all UE must support it rather than the usability is unclear.  |
| CMCC | Share the same view with Sony, it seems there is no need to reserve that “the usability of this capability is not clear at this point” |
| ZTE | There is some difference between the meaning of the original wording and revision proposals. A UE not reporting its support of the function does not mean that the UE has to have the capability, or NW may presume this capability either. We may just keep the first sentence as it is now and revise “the usability of this capability is not clear at this point” to “further study the usability of this capability”. |
| Apple | The proposal in agreement part seems a little confusing. If the usage of this capability is not clear, it is proposed to keep open for further study. The wording from Oppo is more preferred. |

# Sub-topic 3: Rel-18 Beam Correspondence Test Issues

* Overall comment: it may be premature to discuss testability [Ericsson]

**Way forward/Agreement:**

* BC test for RRC\_INACTIVE (if applicable) and IA is at UE maximum output power
	+ what is RRC\_INACTIVE and initial access? [Xiaomi]
	+ Xiaomi: we have concern on the wording. It is related RRC\_inactive mode. RRC\_inactive mode means STD.
	+ Qualcomm: why do we need “if applicable”?
	+ Huawei: similar reason as the previous agreement. RRC\_inactive needs further discussion. Maybe RRC idle and RRC inactive tests are the same. We cannot say RRC inactive is really needed and defined now.
	+ ZTE: to Xiaomi, inactive mode is not equivalent to STD.
	+ OPPO: for RRC inactive, it is premature to say to test as MOP. For how to test and what it looks like .. we are open.
	+ Samsung: it is little complicated. For RRC\_inactive, BC requirement we have no consensus yet. There are discussions on test reduction and test time. The bullet does not exactly reflect the discussion.
	+ ZTE: for testability for RRC inactive mode, RAN5 agreed the simple solution by using loop mode B and other new timer.
* BEAM\_LOCK is not available in RRC\_INACTIVE and IA mode

**Agreement:**

* BC test for RRC\_INACTIVE (if applicable) and RRC\_Idle is at UE maximum output power

**Way forward/FFS:**

* FFS: discuss if and how UE Tx beam should/would change during IA and what are the impact on the test method.
* FFS: Feasibility of testing UEs in Inactive mode
* FFS: Feasibility of triggering SDT in test mode
	+ This is implementation dependent [ZTE]
* FFS: Without beam lock function, achieving UE max output power may be done by holding RAR message to enable power ramping until maximum output power and implication on UE implementation of beam/panel choice during IA.
	+ Clarification on “Without beam lock function” and “implication of UE implementation of beam/pane choice during IA” [Samsung, Sony, vivo, CMCC]
		- Altenative text
		- FFS: Whether and how UE Tx beam should/would change without beam lock function during IA when test equipment is holding RAR to achieving UE max output power. [Sony]
	+ UE may not reach to max power [CMCC, ZTE]
* FFS: Number of tests, test time implications and proposed test time reductions
* FFS: polarization aspects without beam lock function [Samsung] in testing

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| Company | Agree/Disagree, include justification |
| Samsung | For 4th bullet of FFS list, we wonder why beam lock function is involved, and could proponents clarify about the necessity of “implication on UE implementation of beam/panel choice during IA.”?For the last bullet of FFS list, it may be helpful to add the context of “without beam lock function” in the polarization aspects. |
| HW | Regarding 1st Agreement bulletWhether BC requirements need to be specified in RRC\_INACTIVE mode is still FFS. Propose to update as following:* “BC test for RRC\_INACTIVE (if applicable) and IA is at UE maximum output power”
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| Sony | Agree with Samsung on the fourth bullet, suggest to remove “without beam lock function”. This proposal is due to the lack of power up command in IA but not due to the issue of beam lock. |
| vivo | We support keep 4th bullet, we think this bullet is related to the 1st bullet.To Samsung and Sony:If a UE keeps transmitting msg1 but never receives the RAR, what will the UE do in the field? One potential behaviour is UE may think the current beam is wrong and change to another beam and the strategy is depend on the UE implementation.  |
| CMCC | according to 38213, “If prior to a PRACH retransmission, a UE changes the spatial domain transmission filter, Layer 1 notifies higher layers to suspend the power ramping counter as described in [11, TS 38.321]”.Therefore, it seems original “implication on UE implementation of beam/panel choice during IA” is necessary to help identify whether UE has changed its beam.Another question is that how could we know that UE has transmitted with max output power? the time to allow UE transmit with max transmit power should be taken carefully because once PREAMBLE\_TRANSMISSION\_COUNTER equal to max value, UE will assume initial access fails. We should make sure the time for UE to achieving max power should be limited before PREAMBLE\_TRANSMISSION\_COUNTER equal to max value. |
| ZTE | On the third FFS bullet on triggering SDT in test mode, this may involve many factors, and some may be purely UE implementation dependent. On the fourth FFS bullet, holding RAR message so UE will ramp its preamble power, until maximum output power. However, UE may stop before reaching maximum output power if overseeding the maximum number of trials, thus the test should be designed to avoid this. |
| Xiaomi | What is the meaning of RRC\_INACTIVE and IA in 1st and 2nd agreement bullets? Does RRC INACTIVE specifically refer to RA-SDT and CG-SDT? In my understanding, the process from Inactive mode and Idle mode to connected mode is called initial access. |
| Sony | Thanks to the explanation from vivo. After some offline discussion and clarification, we understand the reasoning of “Without beam lock function” in fourth bullet point is to address “the UE beam/panel choice”. To avoid misunderstand, we propose a wording refinement for fourth bullet point:¨* FFS: Whether and how UE Tx beam should/would change without beam lock function during IA when test equipment is holding RAR to achieving UE max output power.
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| Ericsson | The points brought up are valid and should be considered in the work. But how can we decide upon testability before the test method/configuration and scope have not even been agreed? |