**3GPP TSG-RAN WG1 Meeting #101-e R1-20xxxx**

**e-Meeting, May 25 – June 05, 2020**

**Agenda Item: 7.2.2.2.2**

**Source: Moderator (Huawei)**

**Title: Summary of [101-e-NR-unlic-NRU-InitAccessProc-06]**

**Document for: Discussion**

# Introduction

This document captures the discussion of the following email thread:

[101-e-NR-unlic-NRU-InitAccessProc-06] Email approval for a reply LS to R1-2003273 by 5/28. To be managed under 7.2.2.2.2 – Jiayin (Huawei)

# Discussion

In RAN1#99, the following agreement was reached.

Agreement:

A UE shall not average CSI-RS measurements for channel estimation across different transmission bursts from the UE's perspective.

FFS: Potential issues due to AGC

It is captured in section 5.2.1.1 Reporting settings of TS38.214 v16.1.0 as following.

For operation with shared spectrum channel access, the UE should not average CSI-RS measurements for channel estimation from occasions of an NZP CSI-RS (defined in [4, TS 38.211]) located in different DL transmissions burst (defined in [X, TS 37.213]).

In RAN4#94bis-e, RAN4 sent an LS [1] to RAN1 stating the following observations.

* It is unclear whether the UE is able to distinguish whether the CSI-RS measurement are from different transmission bursts.
* The different transmit power of CSI-RS has impact on CSI-RS based L1-RSRP, RLM, BFD and CBD.
* The different transmit power of CSI-RS may lead to AGC problem
* The UE has to average CSI-RSs across different bursts to meet requirements and the UE will assume the power does not change over L1-period

Finally, RAN4 ask confirmation from RAN1 whether UE can assume that CSI-RS (for L1-RSRP, RLM, BFD and CBD) is transmitted with the same transmit power across different occasions during the measurement period (L1-period), and whether this also applies to SSB-based RRM measurements.

In the appendix, the views from companies are summarized.

* 8 companies (all companies providing feedback) supported CSI-RS for **RLM** have same transmit power across different occasions during the measurement period.
* 7 companies supported CSI-RS for **BFD and CBD** have same transmit power across different occasions during the measurement period.
* 5 companies supported CSI-RS for **L1-RSRP** have same transmit power across different occasions during the measurement period.
* 4 companies supported the constant transmit power assumption also applicable to **SSB-based RRM** measurement.
* 2 companies further clarified that the RAN1 agreement was only for CSI measurement.
* 1 company stated that there is no RAN1 impact.

According to section 4.1 in TS38.214, the UE assumption of same transmit power of SSB or CSI-RS can be guaranteed, if SS-RSRP or CSI-RSRP is used for L1-RSRP.

**4.1 Power allocation for downlink**

…

For the purpose of CSI-RSRP, CSI-RSRQ and CSI-SINR measurements, the UE may assume downlink EPRE of a port of CSI-RS resource configuration is constant across the configured downlink bandwidth and constant across all configured OFDM symbols.

…

On the other hand, L1-RSRP is one of CSI-related quantities in CSI reporting. It should be clarified whether L1-RSRP should be regarded as one of “CSI-RS measurements for channel estimation”.

Following two alternatives could be considered:

**Alt 1:** UE can assume same transmit power of CSI-RS for L1-RSRP**.** Add clarification in section 5.2.1.1 in TS38.214 stating that it is possible to average L1-RSRP measurement on NZP CSI-RS located in different DL transmissions burst.

**Alt 2:** UE cannot assume same transmit power of CSI-RS across different occasions during the measurement period for L1-RSRP measurement. Some updates on section 4.1 in TS38.214 is required.

**Therefore, please provide responses in the tables below to the following questions:**

**Q1: Do you agree that CSI-RS for RLM, BFD and CBD is transmitted with the same transmit power across different occasions during the measurement period?**

|  |  |
| --- | --- |
| Company | View |
| Huawei, HiSilicon | Yes |
| MediaTek | Yes |
| LG Electronics | Yes |
| Nokia, NSB | Yes |
| Samsung | Yes |
| Ericsson | I have some fundamental comments about how this discussion is framed, and in the reply LS to RAN4 we may need to clear up some confusion.  In the same section of 38.214 as quoted above, there are two paragraphs that specify how the UE determines the CSI-RS EPRE (see highlighted text below). It is calculated by an RRC configured offset (*powerControlOffsetSS*) to an RRC configured value of the the SS/PBCH block power (*ss-PBCH-BlockPower*). This means that once the CSI-RS resource is configured, whatever type it is the power is fixed unless it is reconfigured at some point (rare), so of course it is constant across measurement periods.  Please note that this applies to CSI-RS of all types. There is no need to differentiate between CSI-RS for RLM, BFD, CBD, L1-RSRP, etc.  In some sense, it is unfortunate that we made the following agreement:  Agreement:  A UE shall not average CSI-RS measurements for channel estimation across different transmission bursts from the UE's perspective.  FFS: Potential issues due to AGC  because it seems to have caused some confusion in RAN4. I would propose that we be bold and remove the agreement from the RAN1 spec, since it is not needed in light of the above power and power offset parameters.  Extract from 38.214 Section 4.1  The downlink SS/PBCH SSS EPRE can be derived from the SS/PBCH downlink transmit power given by the parameter *ss-PBCH-BlockPower* provided by higher layers. The downlink SSS transmit power is defined as the linear average over the power contributions (in [W]) of all resource elements that carry the SSS within the operating system bandwidth.  The downlink CSI-RS EPRE can be derived from the SS/PBCH block downlink transmit power given by the parameter *ss-PBCH-BlockPower* and CSI-RS power offset given by the parameter *powerControlOffsetSS* provided by higher layers. The downlink reference-signal transmit power is defined as the linear average over the power contributions (in [W]) of the resource elements that carry the configured CSI-RS within the operating system bandwidth. |

**Q2: Do you agree that CSI-RS for L1-RSRP is transmitted with the same transmit power across different occasions during the measurement period?**

|  |  |
| --- | --- |
| Company | View |
| Huawei, HiSilicon | Yes. Clarification on L1-RSRP is not one of “CSI-RS measurements for channel estimation” should be added in 5.2.1.1 in TS38.214. |
| MediaTek | Yes. Clarification in 5.2.1.1 in TS38.214 is okay. |
| LG Electronics | Yes. Do we need to specify only for CSI-RS for L1-RSRP, or also for CSI-RS for RLM/RRM/CBD/BFD? |
| Nokia, NSB | Yes. See Q1 for CSI-RS for RLM/CBD/BFD |
| Samsung | Yes. |
| Ericsson | Please see comment for Q1 – no need to differentiate between CSI-RS types |

**Q3: Do you agree that SSB (for SSB-based RRM measurement) is transmitted with the same transmit power across different occasions during the measurement period?**

|  |  |
| --- | --- |
| Company | View |
| Huawei, HiSilicon | Yes |
| MediaTek | Yes |
| LG Electronics | Yes, also for SSB for RLM/BFD/CBD. |
| Nokia, NSB | Yes, and for SSB for RLM/BFD/CBD as well. |
| Samsung | Yes |
| Ericsson | Please see comment for Q1 – SS/PBCH power is RRC configured. Clearly it is constant. |

# Discussion Outcome

To be completed at the conclusion of the email discussion

# References

1. R1-2003273, “LS on transmit power of CSI-RS across different occasions”, RAN4, RAN4#94bis-e, 3GPP TSG-RAN WG1 Meeting #101-e, May 25th – June 5th, 2020

# Appendix

The summary of companies’ view in the tdocs.

Table 1: Related Contribution Summary

|  |  |  |
| --- | --- | --- |
| **Company** | **Discussion Tdoc** | **Related Proposal and Rationale** |
| ZTE, Sanechips | R1-2003448  R1-2003837 (draft LS) | Proposal 6: CSI-RS (for L1-RSRP, RLM, BFD and CBD) should be transmitted with the same power across different occasions during the measurement period. The gNB implementation can achieve this purpose without any specification impacts. |
| VIVO | R1-2003354 | Observation 1: CSI-RS resources can be separately configured for different purposes.  Proposal 1: UE can assume EPRE of the CSI-RS resources for RRM, RLM, BFD, L1-RSRP, CBD constant once configured. It is up to network implementation to guarantee the EPRE constant across different occasions.   * Send LS to RAN4 to inform above decision.   Observation 2: For SSB based RRM in unlicensed spectrum, the UE can still assume that SSBs transmitted with the same block index on the same center frequency location are quasi co-located with respect to average gain.  Proposal 2: Send LS to RAN4 to inform above understandings. |
| LG | R1-2004008 | Proposal: UE shall assume that CSI-RS or SSB (for RRM, RLM, BFD, and CBD) is transmitted with the same transmit power across different DL transmission bursts during the measurement period.   * FFS: Whether to have RAN1 specification impact * Send a reply LS to RAN4 to inform this decision. |
| OPPO | R1-2004093 | Observation 1: the pointed RAN1 agreement by RAN4 seems to be only applicable for CSI measurement for CSI reporting.  Observation 2: In NR Rel.15, UE assumes the same transmit power of CSI-RS across different occasion.  Proposal 1: For RLM, BFD and CBD in NRU, UE may use the same assumption on the CSI-RS transmit power as Rel.15.  Proposal 2: For RRM in NRU, the UE may assume the same transmit power of CSI-RS or SSB as in Rel.15. |
| Nokia, NSB | R1-2004513  (draft LS) | RAN1 agrees that a UE may average CSI-RS for L1-RSRP, RLM, BFD and CBD across different bursts if it validates CSI-RS within the bursts, but shall not average CSI-RS across different bursts for purpose of CSI estimation (as per above RAN1 agreement). |
| Huawei, HiSilicon | R1-2003510  R1-2004624  (draft LS) | Proposal 9: Confirm RAN4’s question that a UE can assume that  • CSI-RS (for L1-RSRP, RLM, BFD and CBD) is transmitted with the same transmit power across different occasions during the measurement period.  • SSB (for SSB-based RRM measurements) is transmitted with same transmit power across different occasions during the measurement period. |
| Samsung | R1-2003858 | Proposal 2: UE can assume that CSI-RS is transmitted with the same transmit power across different occasions during the measurement period. |
| Qualcomm | R1-2004441 | Proposal 3: UE expects CSI-RS for RLM to have fixed transmit power over all COTs. |