3GPP TSG-RAN WG1#80 R1-150555

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ERICSSON

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TITLE: 2D ARRAY ANTENNA IMPACT ON RAN4

AGENDA ITEM: 7.2.4.1

DOCUMENT FOR: DISCUSSION AND DECISION

SUMMARY

- The large 2D antenna structures with up to 64 TXRU and AAS techniques under study in RAN1 requires a giant leap in base station antenna and radio design, building practice and testing
  - The new building practice paradigm necessitates new approaches to set requirements such that co-existence, co-location and acceptable system performance can be guaranteed
  - The RAN4 effort in moving from WCDMA to LTE leap was small in comparison to what RAN4 are facing for array systems, since the basic technology building practices did not change significantly at that time

- AAS progress in RAN4 was very slow during Rel.11 & 12
  - There is still, after 3 years of discussion, unclear how to handle larger number of AAS antenna ports, a long list of open issues remain
    - The first version of the AAS specification will be sufficient for first AAS products with a low number of transceivers

- Therefore, it is important that RAN4 completes the current AAS WI and study to be prepared for the implications of the larger arrays that reflects the RAN1 SI and that RAN4 is continually informed about RAN1 progress
  - Otherwise there is a risk that EB/FD-MIMO becomes a paper product with which limits the ability to build and deploy EB/FD-MIMO
  - We don't want to risk a WI being delayed by an insufficient base in RAN4 for developing FD-MIMO requirements
  - RAN4 need to be aware of RAN1 studies in order to prepare a good baseline for eventually building FD-MIMO requirements

PROPOSAL

- Proposal: Agree to inform RAN4 with RAN1 findings in the EB/FD-MIMO SI by sending an informative LS after each WG#1 meeting

APPENDIX: SOME OF THE 2DAA ISSUES THAT RAN4 NEED TO ADDRESS

- It is not clear how unwanted emissions from a 2D array sum and the extent to which they sum coherently with arrays with a larger number of antenna elements. The need to build filtering to meet emissions requirements will directly impact the feasibility of building large arrays in different frequency ranges and the antenna spacing that can be achieved.

- Regarding mutual coupling, it is not clear how much isolation can be achieved between array elements in practice when there are many antenna elements.
  - The mutual coupling can have an impact on radiated emissions and potentially transmitted signal quality (EVM) that do not appear in current conducted RAN4 tests, but RAN4 has identified a Rel-13 solution for guaranteeing radiated emissions and EVM for densely packed arrays. Whether or not it is adequate for EB/FD-MIMO needs to be analyzed. Note that there will be no radiated emissions requirements for AAS in Release 12 and there has been no co-location issue study for AAS and no related requirements.

- It is not clear whether and in such case how the conducted radio sensitivity requirement should be set for a large 2D array antenna; it does not make sense to require all [64] radios to have the same sensitivity that would be needed for a non AAS base station of the same class. Furthermore, it is also not clear whether it is feasible to build a 64TX array and still use conducted requirements

- There has not been much investigation of uplink blocking effects and Minimum Coupling Loss with this type of array; RAN4 investigations have focused on macro scenarios

- RAN4 has still not fully sorted out how to do radiated EIRP requirements that capture all array effects based on beam declarations; such requirements would clearly be essential and may need extending from the current RAN4 baseline for FD-MIMO

- Similarly, RAN4 has not yet completed defining a radiated sensitivity requirement, which is needed to capture all factors of a built array that influence receiver performance. RAN4 is still discussing whether there should be any minimum requirement and does not have any idea of the type of scenario that should be analyzed for setting a minimum OTA sensitivity for this type of system.

- Most requirements in RAN4 remain conducted requirements, which require antenna connectors to be built. It is not clear whether FD-MIMO hardware architectures with a large number of ports can support antenna connectors.

- In addition to these things, RAN4 has within their current work never addressed the issue of how to capture beamforming performance with requirements; the discussion is fully focused on core RF requirements

- RAN4 has yet to commence a detailed assessment of Over the Air test techniques and their associated accuracies

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