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Considerations on the Multi-SIM study

Spreadtrum Communications

Clarification on the definition for Dual/Single Rx and Dual/Single Tx

- In SA1 TR 22.834, the Dual Rx/Single Rx/Single Tx were once defined as below
  - "*NOTE 1: The terminal behaviour with respect to the simultaneous handling of multiple USIMs may depend on the terminal capabilities (e.g. terminal with single Rx / single Tx vs terminal with dual Rx / single Tx vs terminal with dual Rx / dual Tx), wherein dual Rx allows MUSIM UE to simultaneously receive traffic from two networks, single RX allows MUSIM UE to receive traffic from one network at one time, single Tx allows MUSIM UE to transmit traffic to one network at one time.*"
  - In the S1-192863, which was approved in SA1#87, this NOTE1 has been removed and "are to be captured in the description of the normative work."

- In RAN, the Dual/Single Rx and Dual/Single Tx needs to be further clarified
  - The number Tx / Rx processing chains are the combination of BB+RF+RFFE+Antenna
  - Each band of each band combination that UE supports may have different number of Tx / Rx processing chains
  - Some band combination for inter-MNO case may not be supported by the UE, working band combination switch might be needed
  - Dual/Single Rx and Dual/Single Tx may not be a permanent UE character, a Dual Rx Dual Tx UE may become a Single Rx Single Tx UE when the working band combination changes.

Clarification on the definition for RAT Concurrency

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- The related RRC States should be clarified for each RAT Concurrency
  - Modulator’s Note for Q2, “NR SA means NR-SC and NR Idle mode. LTE only means LTE-SC and LTE Idle mode.”, might need some more clarification
  - NR Inactive state should be considered together with NR Idle mode
  - NR-SC, LTE-SC should be clearly defined as Connected state, and NR-CA/ LTE-CA/ NR-DC/ EN-DC should also be considered in Connected state
  - The eLTE (LTE_Connected_to_5GC) has the INACTIVE state while LTE does not have this RRC state, whether to define eLTE related concurrency
- In the email discussion, different companies use different kinds of RAT Concurrency expression which the meaning is not very clear
  - Whether “LTE (only) + EN-DC” and “EN-DC + NR (SA)” means UE must have 3 connections to two networks? Or just means “LTE Idle + EN-DC” and “EN-DC + NR Idle/Inactive”?
- In RAN, the different RAT Concurrency need to be further clarified

Use cases of Rel-17 MUSIM study

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- In the email discussion, 9 use cases are raised for the Release -17 MUSIM Study
  - Case 1: Collision between Paging reception from network A and B
  - Case 2: Paging delivery to UE on network A while the UE is actively communicating (i.e. RRC connected mode) with network B
  - Case 3: UE entering in RRC Connected mode in network A from Idle/Inactive mode, while UE is already in RRC Connected mode in network B
  - Case 4: UE communicates with network A and B simultaneously
  - Case 5: Interference between different USIMs including dual Tx/ dual Rx and single TX/dual Rx
  - Case 6: Reduce UE power consumption
  - Case 7: Cell selection and reselection enhancement
  - Case 8: Collision between paging reception from network A and MSI/SI-message reception from network
  - Case 9: Collision between MSI reception from network A and SI-message reception from network B
- We are fine with the above use cases.

TDM solutions for use case 3 and use case 4

- Some companies mentioned TDM solutions for Single Tx / Single(Dual) Rx UEs for use case 3 and use case 4 to start one active RRC connection while another active RRC connection is on going.
- Some issues about the above solution
  - Measurement action for network A will take effect on network B’ s measurement performance without the additional RF/BB capability
  - For different TDM pattern for network A and network B, how to define the proper HARQ operation for both networks
  - Large TA difference might exist between network A and network B, which might cause Tx / Rx overlapping under some certain TDM pattern

- We think more evaluation work should be done for the above solution, especially for RAN4 and RAN1 part work load, before any decision of the study scope can be made.

Preferred MUSIM Study Scope

- Study mainly focuses on Dual (U)SIM scenario
- Consider different UE Tx Rx capabilities, like Single Rx/Single Tx, Dual Rx/Single Tx, Dual Rx/Dual Tx
- High priority RAT Concurrency in Release 17, NR SC + NR SC, LTE SC/CA +NR SC
- Provide Service Category to the DSDS MUSIM UE
- Fast service suspend and resume procedures
- UE coordinated TDM operations for receiving Paging, SI or performing measurement in network A with maintaining active connection in network B
- UE initialed capability quick coordination and advertise procedures towards the networks it has active RRC connection
- UE uplink power sharing mechanisms towards the networks it has active RRC connection

Conclusion

- Proposal 1: RAN discusses to clarify the exactly meaning of Single/Dual Tx and Single/Dual Rx.
- Proposal 2: RAN discusses to clarify the exactly meaning of each RAT Concurrency included in the use case scope.
- Proposal 3: RAN evaluates the RAN4 and RAN1 standard work load for the TDM solutions of use case 3 and use case 4.

THANK YOU!