RITT

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Candidate enabling techniques for LTE-Advanced

RITT

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Outline

- *Spectrum-related issues*
- *Relay*
- *Distributed antenna systems*
- *Challenges from Home eNodeBs*
- *Basic transmission and multiple access*
- *Modulation and coding*
- *MIMO*
- *More effective cell-edge improvements*
- *Self organization networking*
- *Summary*

Spectrum-related issues

- Large-bandwidth optimization:
  - *Depends on if larger bandwidths need to be supported.*
- Spectrum-specific optimization, e.g. for UHF and 3.4GHz.
- Multi-spectrum cooperation:
  - *Requirements fulfilled by cooperation of multi-spectrum.*
  - *Shared common channel between multiple bands*
  - *Effective inter-band user scheduling/handover/re-selection*
- Multi-spectrum aggregation:
  - *Joint transmission/reception across multiple bands.*
- Flexible spectrum use and Spectrum sharing:
  - *First focus on vertical sharing between overlapped WA and LA cells.*
  - *Feasibility of sharing between operators and RITs can be studied.*

Relay

- *Effective solution for improving the coverage especially for 3.4GHz bands, indoor coverage and rural areas.*
- *Potentially improve the system throughput through the "cell shrinking gain".*
- *However, a series of challenging topics need to be study to facilitate the use of relay:*
  - *A reasonable evaluation model reflecting practical deployment scenarios needs to be identified, e.g. number of relay stations per cell and their channel models.*
  - *Interference control and relaying timing arrangement, e.g. frame structure design.*
  - *Amplify-and-forward vs demod-and-mod vs decode-and-encode.*
  - *Link adaptation and PHY procedure in relay systems, e.g. resource allocation, cell search, power control, ARQ/HARQ.*
  - *Relay station L2/L3 structure.*
- *First focus on simpler scenarios, e.g. two-hop, non-Mesh, non-coordinative, fixed relay in 1st phase.*
  - *Multi-hop relay considered for special scenarios, e.g. large-area rural coverage (no need of multi-cell networking).*

Distributed antenna systems

- Antenna sites distributed in one cell:
  - *Each eNB is distributed into multiple fiber-connected antenna sites.*
  - *Takes both "cell shrinking gain" and "cooperative Tx/Rx gain".*
  - *A reasonable evaluation model reflecting practical deployment scenarios needs to be identified, e.g. number of additional antenna sites and their channel models.*
  - *More practical in indoor scenarios than in outdoor scenarios.*
- Antenna sites distributed over legacy eNB sites:
  - *Baseband units of several neighboring eNBs are gathered in a Macro-eNB. Other eNBs are replaced by fiber-connected antenna sites.*
  - *Takes "cooperative Tx/Rx gain" from joint transmission/reception across neighbor sites.*

Challenges from Home eNodeBs

- *Could be dense deployment if many users like to use them.*
- *Operators partly lose control of network plan*
- *May need more efficient interference management and special network architecture rather than simple self configuration.*

Basic transmission and multiple access

- Compatibility described in SID is guaranteed: Keep current MA at least in the spectrum and scenarios with LTE R8 deployments.
- Cell edge improvement techniques based on legacy MA could be considered.
- Additional MA options meeting following targets are not be excluded at the starting point of the study. Complexity of additional options needs to be carefully considered.
  - *Achieving substantially higher performance.*
  - *Providing better optimization in new spectrums, e.g. 3.4GHz and UHF bands.*
  - *Providing better optimization in new deployment scenarios, e.g. indoor hotspot and relay systems.*

Modulation and coding

- *Keep current modulation and coding schemes at least in the legacy spectrum and deployment scenarios.*
- *For new spectrum (e.g. UHF and 3.4GHz bands) large bandwidth and new deployment scenarios (e.g. indoor hotspot), more suitable modulation and coding schemes are not be excluded at the starting point of the study, e.g. LDPC.*

MIMO

- Extend beamforming mode to multi-stream version
  - *Beamforming-based SU-MIMO*
  - *Beamfoming-based MU-MIMO*

More effective cell-edge improvements

- *Effective interference cancellation could be considered to deal with increasingly complicated interference structure due to introduction of pico cells, relay stations, and home eNBs.*
- *Tight inter-node coordination and joint transmission/reception between fibre-connected distributed sites.*

Self organization networking

- Self-Installation
- Self-Configuration
- Self-Optimization
- Self-Healing
- Self-Planning
- Support multi-vendor SON

Summary

- Major enabling techniques to meet the requirements:
  - *Multi-spectrum cooperation and aggregations*
  - *Flexible spectrum use and spectrum sharing*
  - *Relay, distributed antenna systems and home eNBs*
  - *Inter-cell interference cancellation and tight coordination*
  - *Multi-stream beamforming*
  - *Self organization networking*

Thanks for Attention