

Source: Ericsson  
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Document for: Discussion



# FLEXIBILITY AND PERFORMANCE OF SELF CONTAINED TRANSMISSIONS

# SELF CONTAINED TRANSMISSIONS - LEAN AND BEAM BASED DESIGN

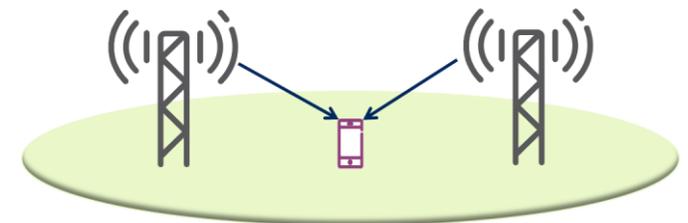


## › Lean-based

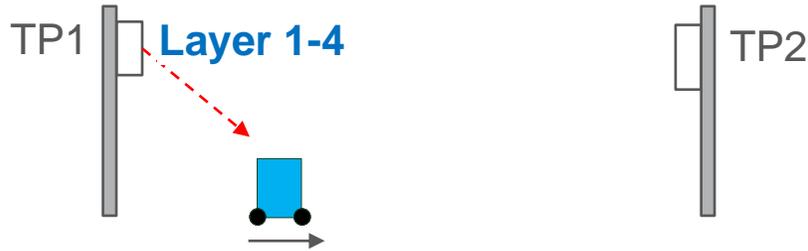
- Minimize always-on transmissions (reference signals, sync signals, broadcasted sysinfo, ...)
- Baseline: all subframes are treated as undefined until explicitly configured
  - › The UE treats a subframe as DL unless instructed to transmit in UL
  - › No assumptions on subframe content made by a UE RX unless it is scheduled in that subframe
  - › Some subframes may contain signals to support beamforming etc
- **Benefits:** Forward compatible, energy efficient, low-load performance

## › Beam-based

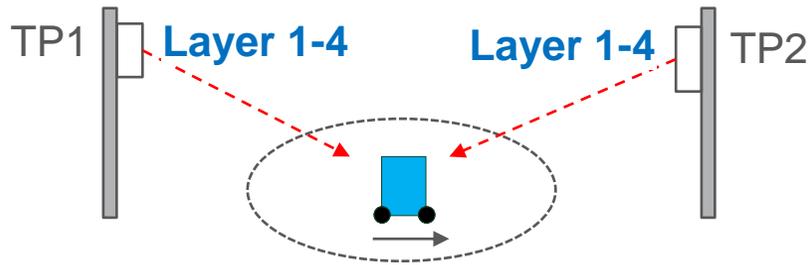
- Minimize dependencies across subframes and (sets of) antenna port(s)
- Self-contained transmissions, processing “per beam and subframe” possible
- A UE may receive transmissions on multiple sets of antenna ports – may originate from different sites
- No (very limited) QCL across different sets of antenna ports
- **Benefits:** Forward compatible, **Multi-point connectivity**



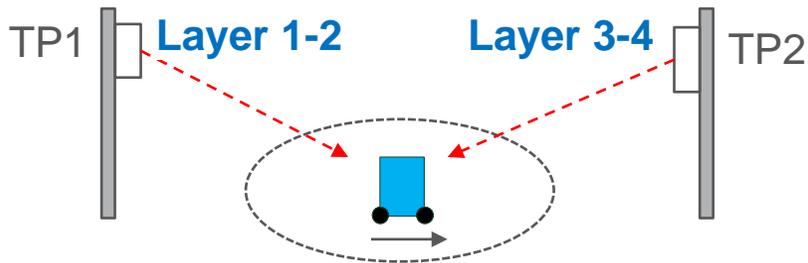
# MIMO WITH MULTIPLE POINT CONNECTIVITY



- > Single transmission point (TP)
  - In line-of-sight
    - > Two layers can be separated with polarization
    - > 3-4 layers is more difficult with small spatial separation



- > Dual TP
  - Layer separation properties similar to single transmission
  - Transmission of 4 layers from both transmission points
  - Each code word is transmitted from both TPs



- > Distributed MIMO
  - 2 layers from each transmission point to one UE
    - > Each code word is transmitted from only one TP
    - > Possibility for self contained transmission from each TP if backhaul is slower
  - Large spatial separation improves layer separation

# OUTDOOR COVERAGE AND MACRO DIVERSITY GAIN



TP 1 only

Total DL Throughput [Mbps]

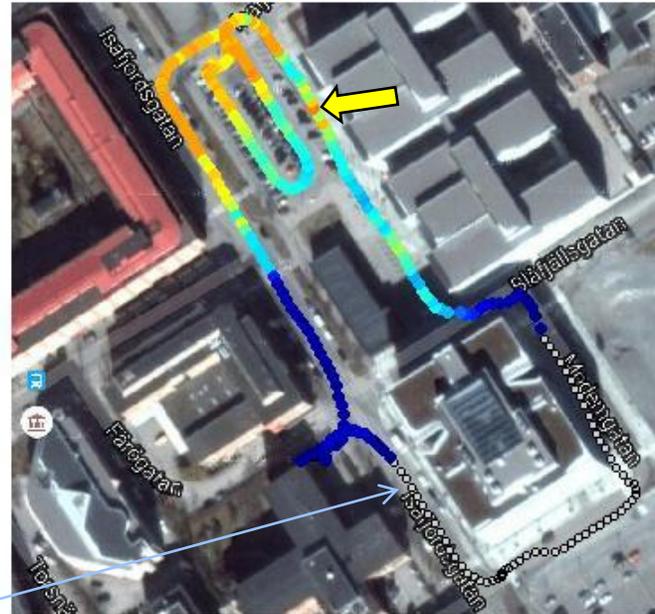


2015

Coverage by TP1

TP 2 only

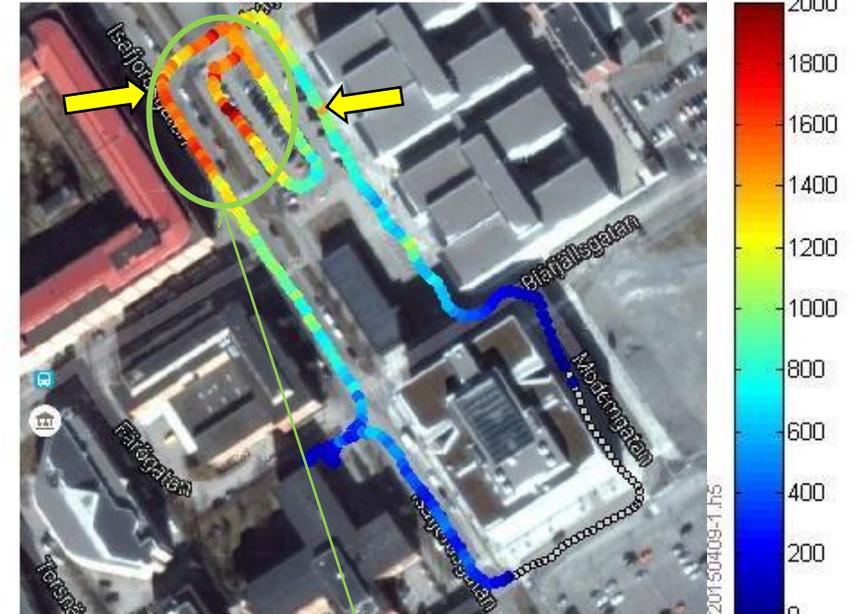
Total DL Throughput [Mbps]



REAL 2015

Distributed MIMO

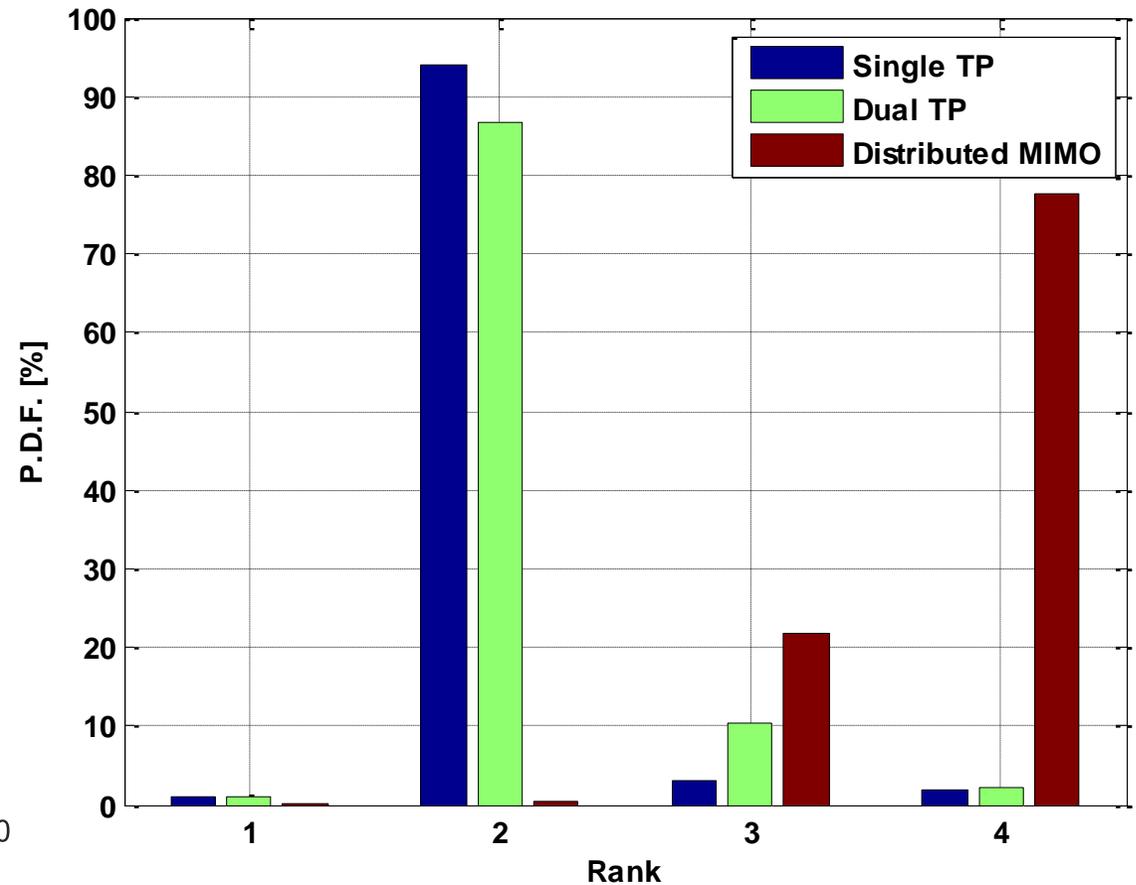
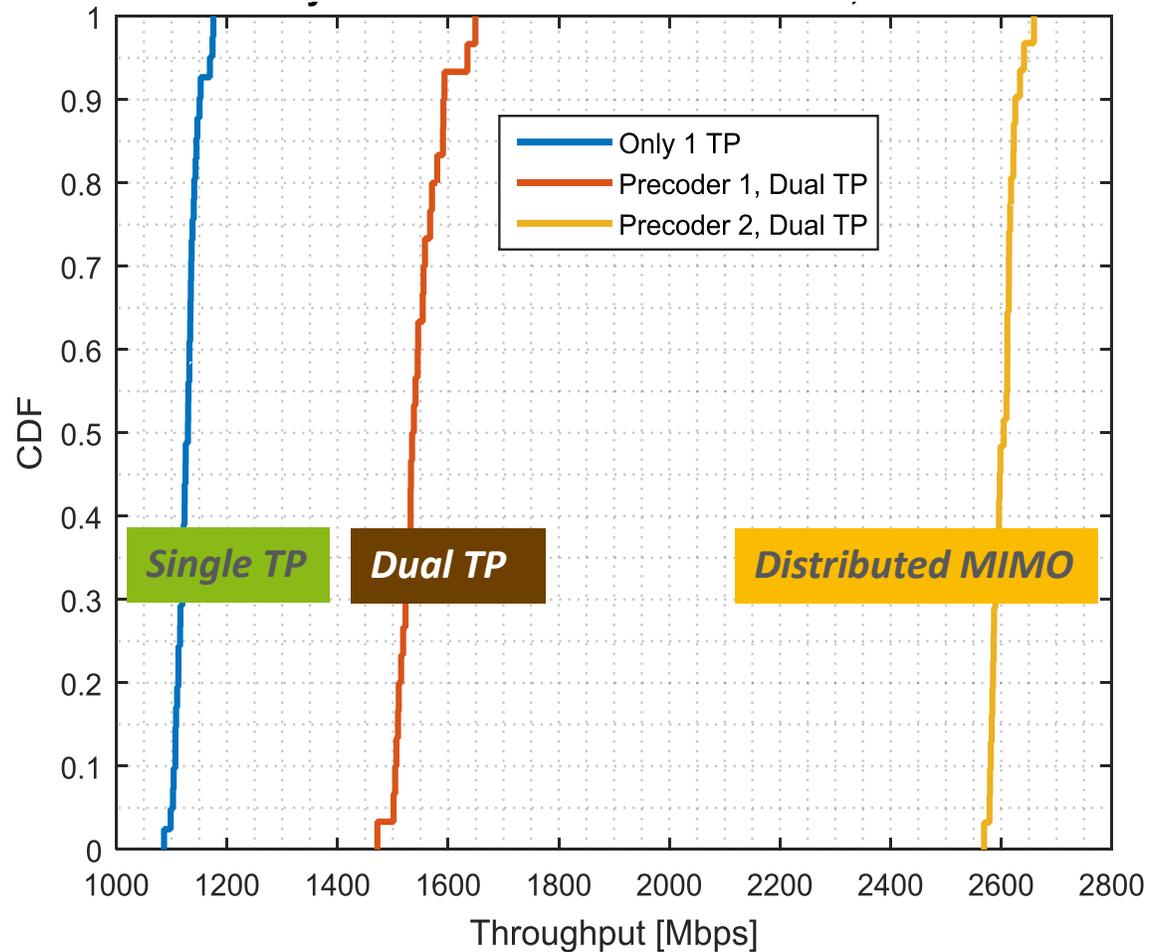
Total DL Throughput [Mbps]



REAL 2015

Area with dual TP/distr. MIMO  
throughput gain

# OUTDOOR THROUGHPUT, STATIONARY UE



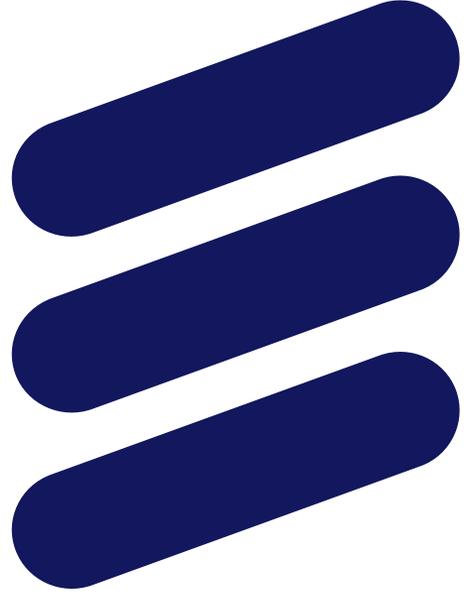
Multi-site (distributed) MIMO is necessary to reach 2.6 Gbps in this LOS scenario

# CONCLUSIONS



- › 2.6 Gbps on 200 MHz demonstrated in outdoor environment corresponding to lightly loaded system
- › Multi-site MIMO using dual TP transmission improves performance in outdoor environment in lightly loaded system
  - Increase transmission rank in LOS with spatial diversity
  - Macro diversity improvement of signal strength
- › Multi-site MIMO using Distributed multipoint transmission enhances single user MIMO performance in LOS and in lightly loaded system
  - Improves layer separation in receiver
  - Needed for a substantial fraction of rank higher than 2
  - Enables 4-layer spatial multiplexing
  - Required for 4x4 MIMO peak throughput outdoor
  - **Enabled by two self contained transmissions, one from each TP**

Study multi-TP MIMO transmissions where each TP may transmit its own self-contained PDCH



**ERICSSON**

# DISTRIBUTED MIMO MEASUREMENT SETUP



- › 15 GHz carrier frequency,
- › 2x100 MHz carrier aggregation,
- › Numerology: LTE scaled 5x, e.g.
  - 75 kHz subcarrier spacing
  - 0.2 ms subframe length
  - 20% CP length compared to LTE
- › 2 transmission points
- › Single user with 4 RX