

Source: Ericsson, Telstra  
Agenda Item: 7.2.3.3  
Document for: Discussion and decision



# Indoor Highly Resolved Channel Measurements at 60 GHz

# Background

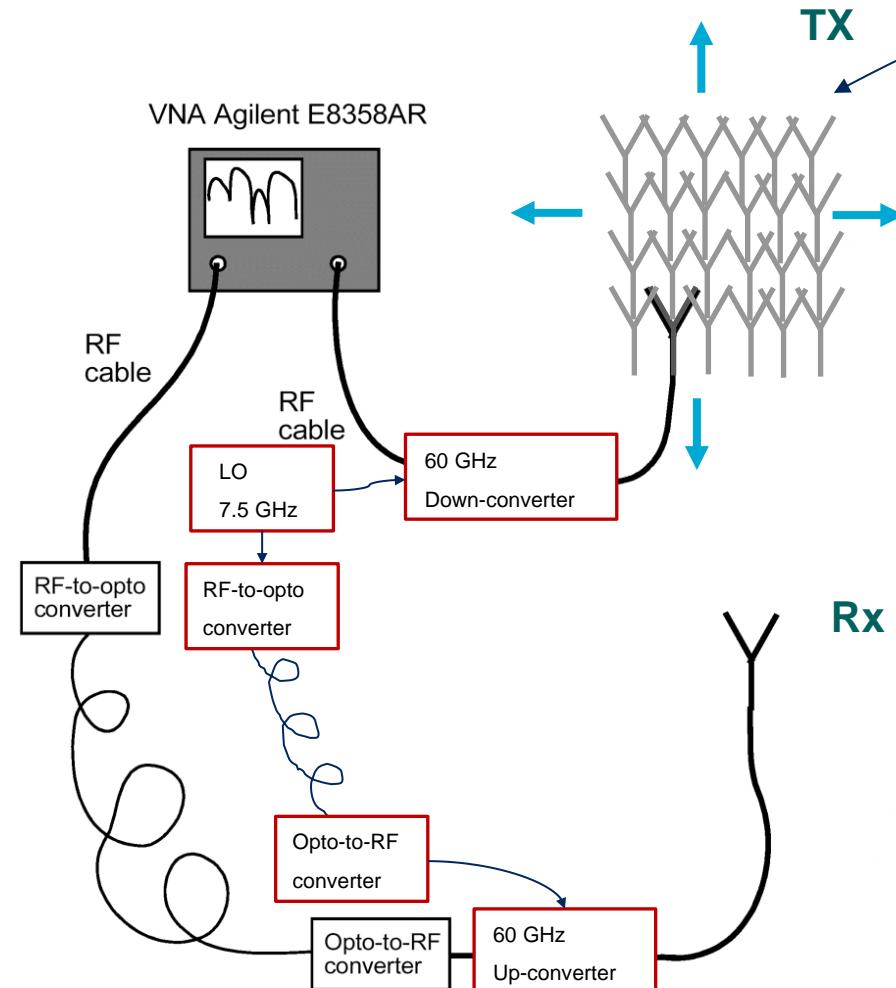


- There is a need to provide a solid basis for high resolution channel parameterization in space and delay
- An angular resolution at the order of one degree and bandwidth of several GHz are needed
- For this purpose an indoor channel measurement campaign has been conducted at 58.7 GHz

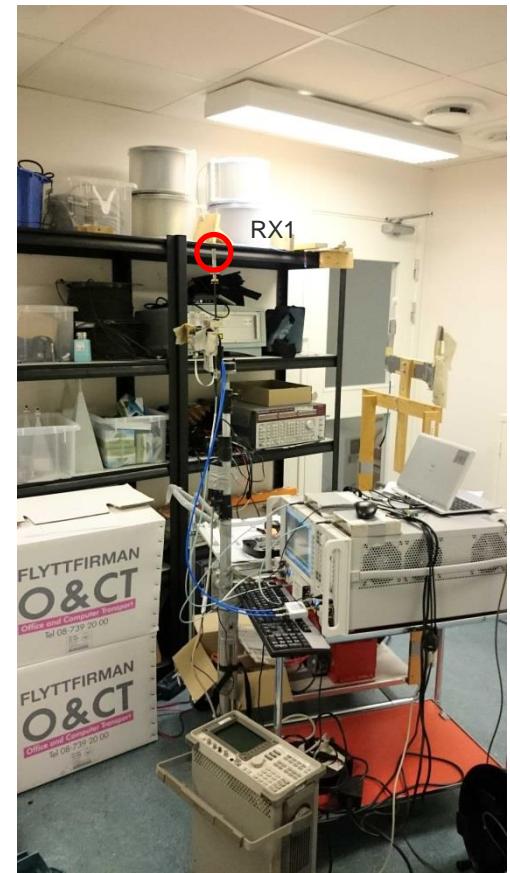
# Measurement Set-Up



- › Planar virtual array 510 mm size and  $256 \times 64 = 16384$  elements
- › 2001 frequency samples in 2 GHz bandwidth (58.68 GHz carrier)
- › FFT transformations from space to angle domain
- › FFT transformations frequency space to delay
- › Hanning window applied
- › Angle resolution at the order of 1 degree



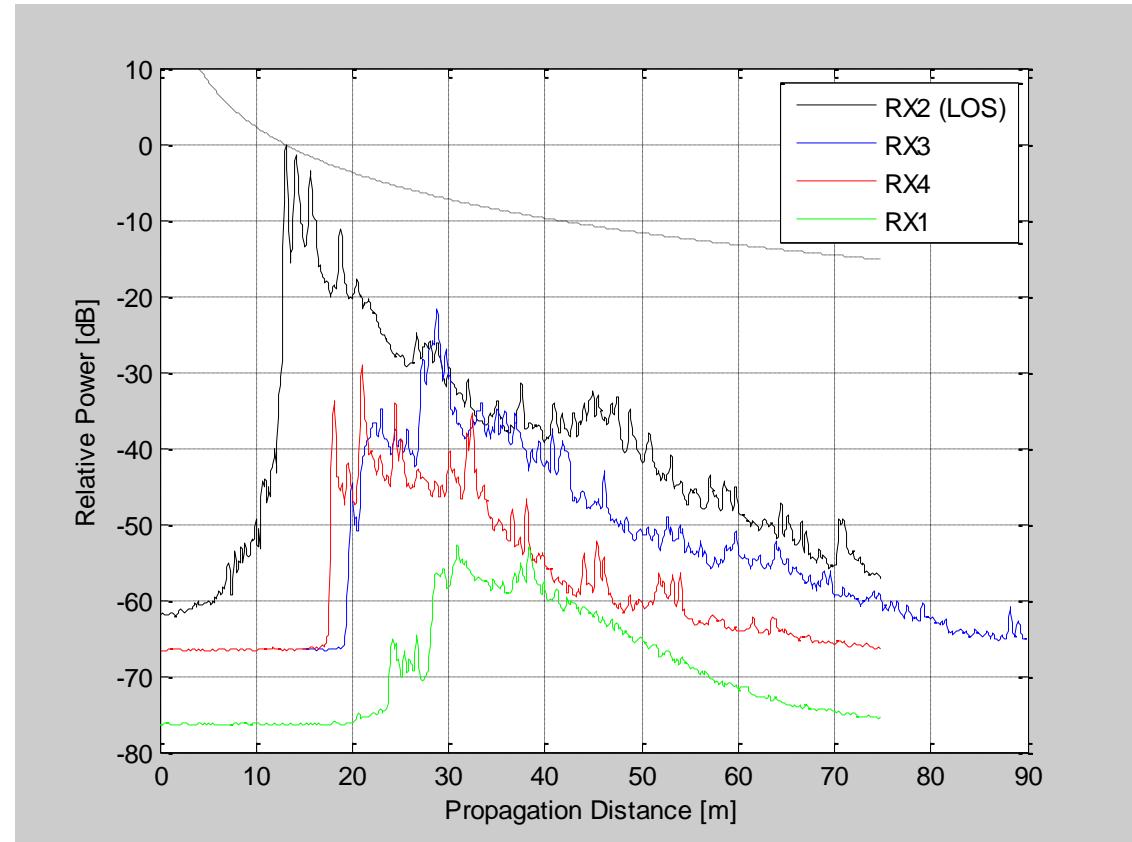
# Measurement Scenario



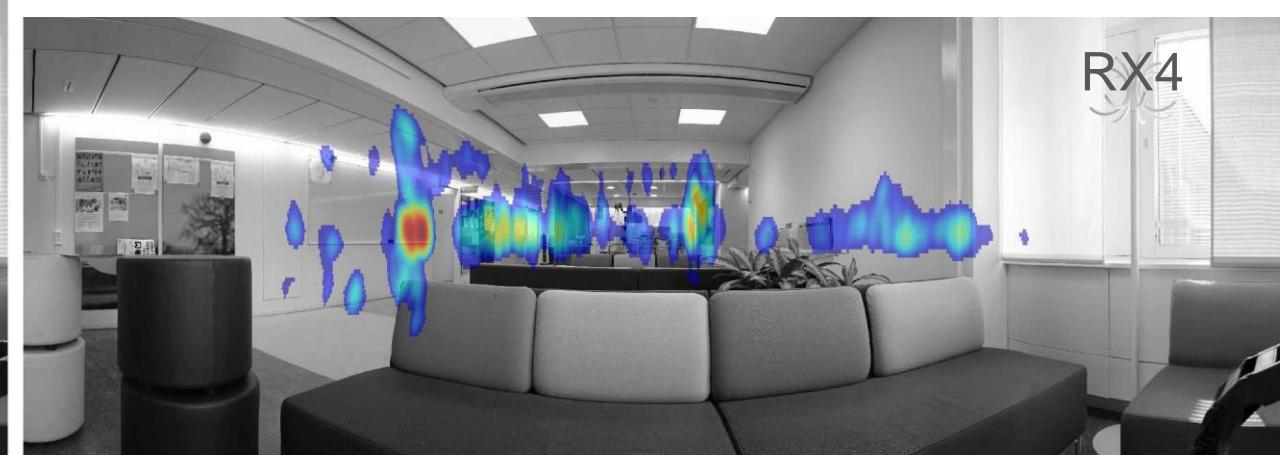
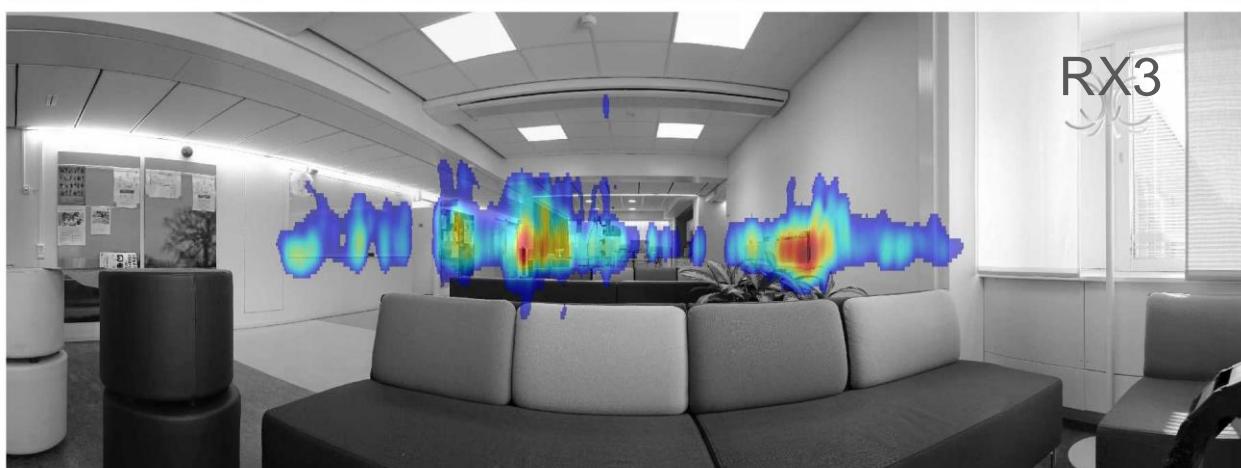
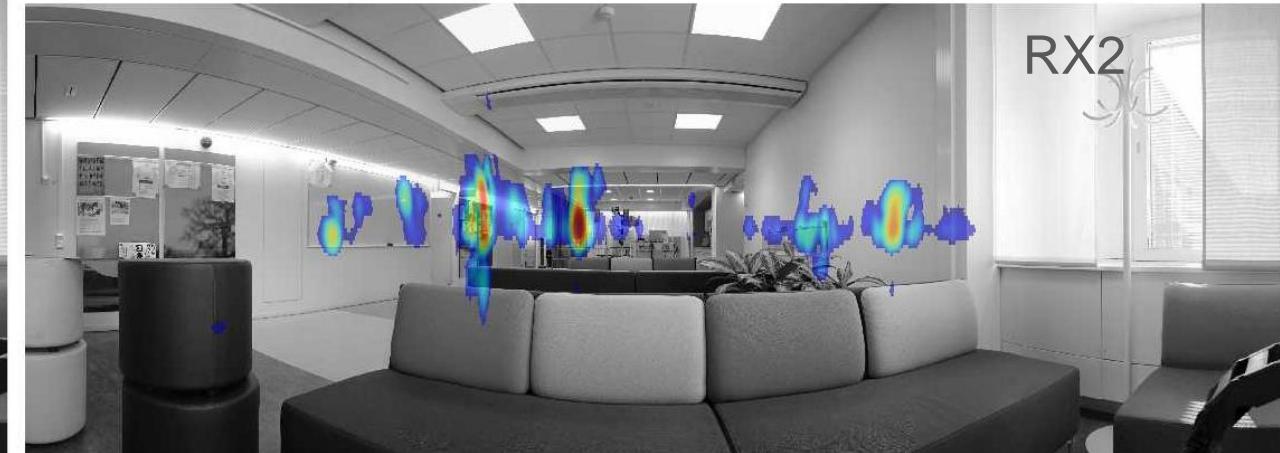
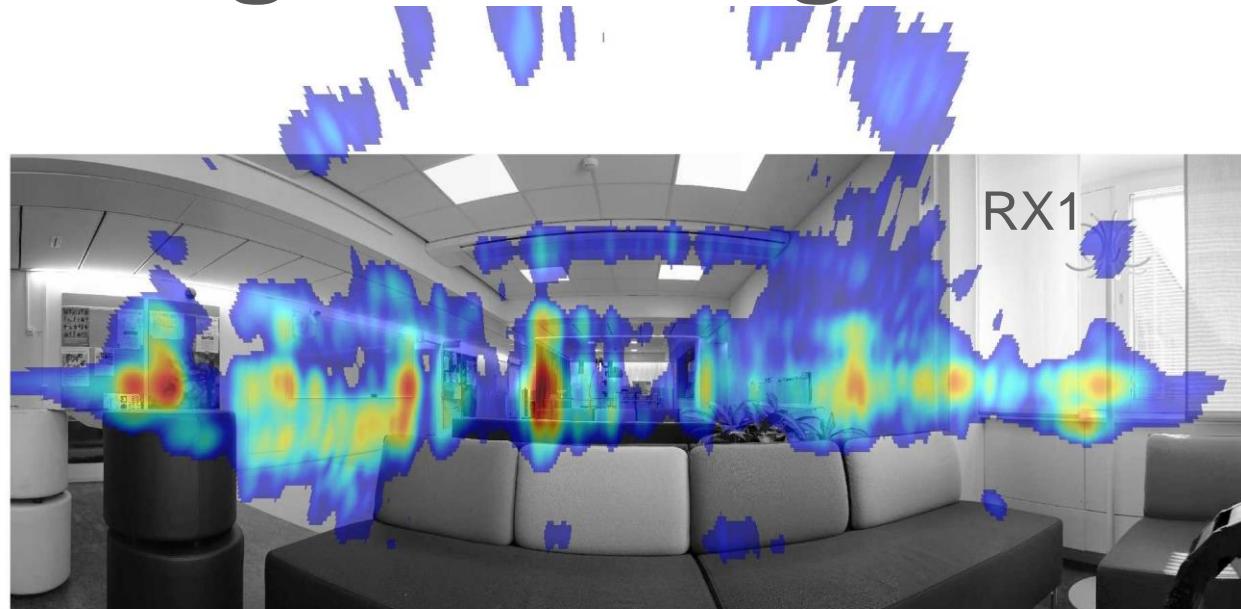
# View from RX2



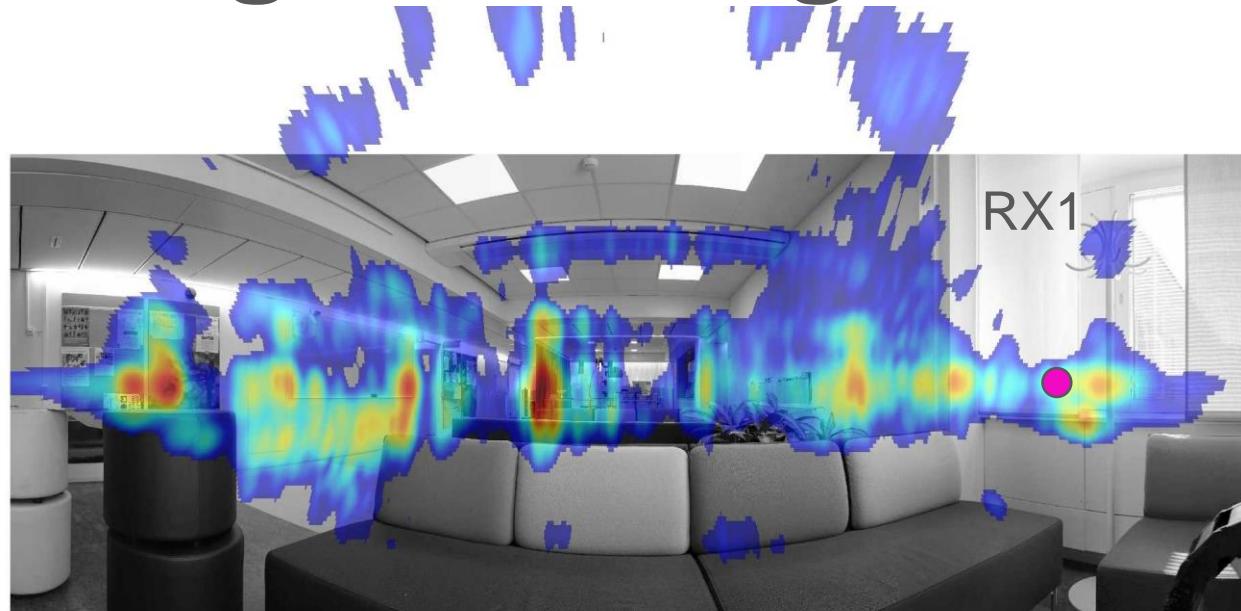
# Power Delay Profiles



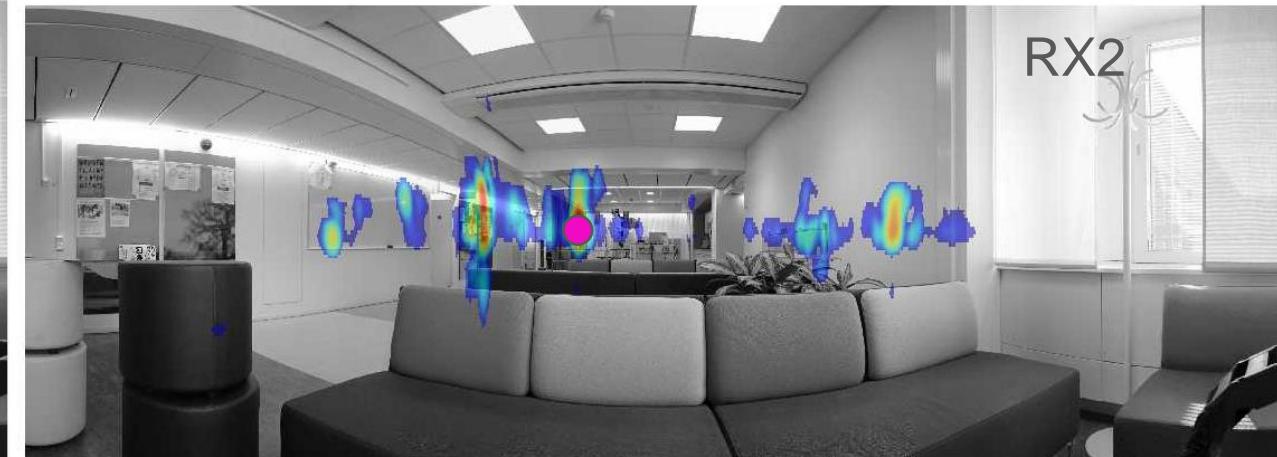
# Signal Strength Viewed from TX



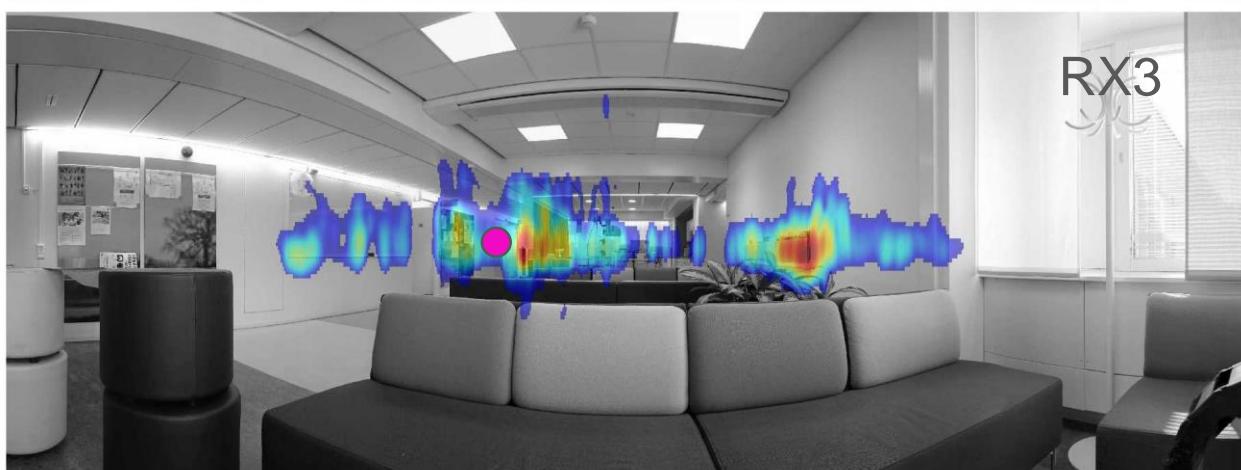
# Signal Strength Viewed from TX



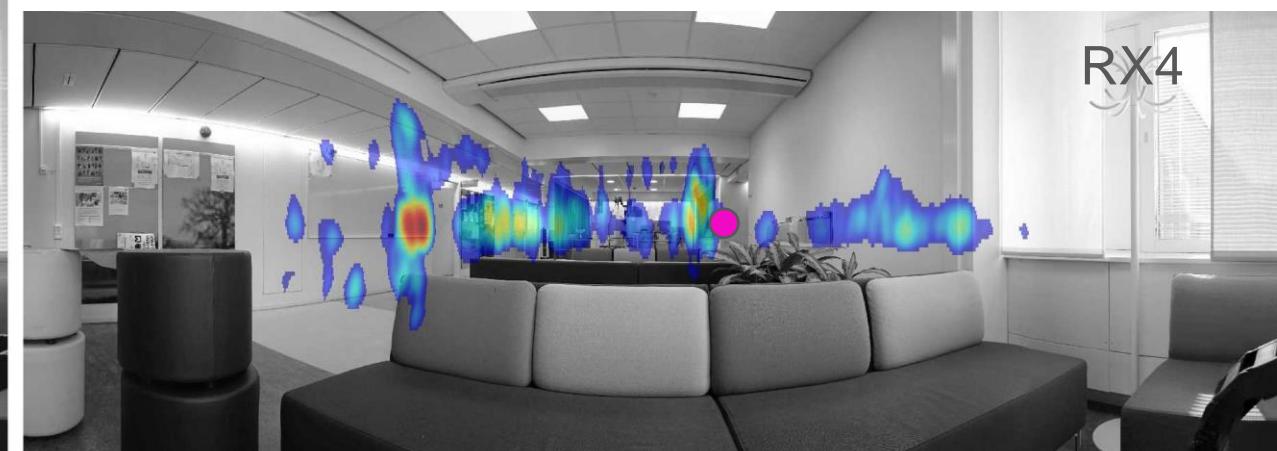
● RX direction



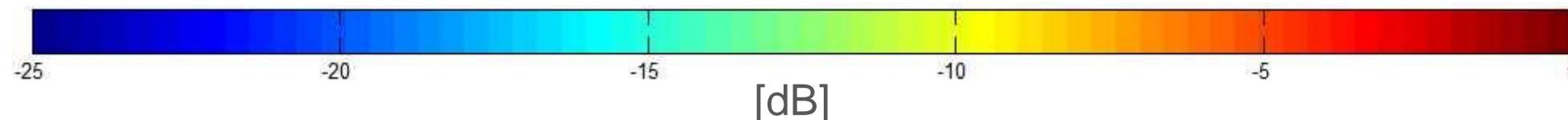
RX2



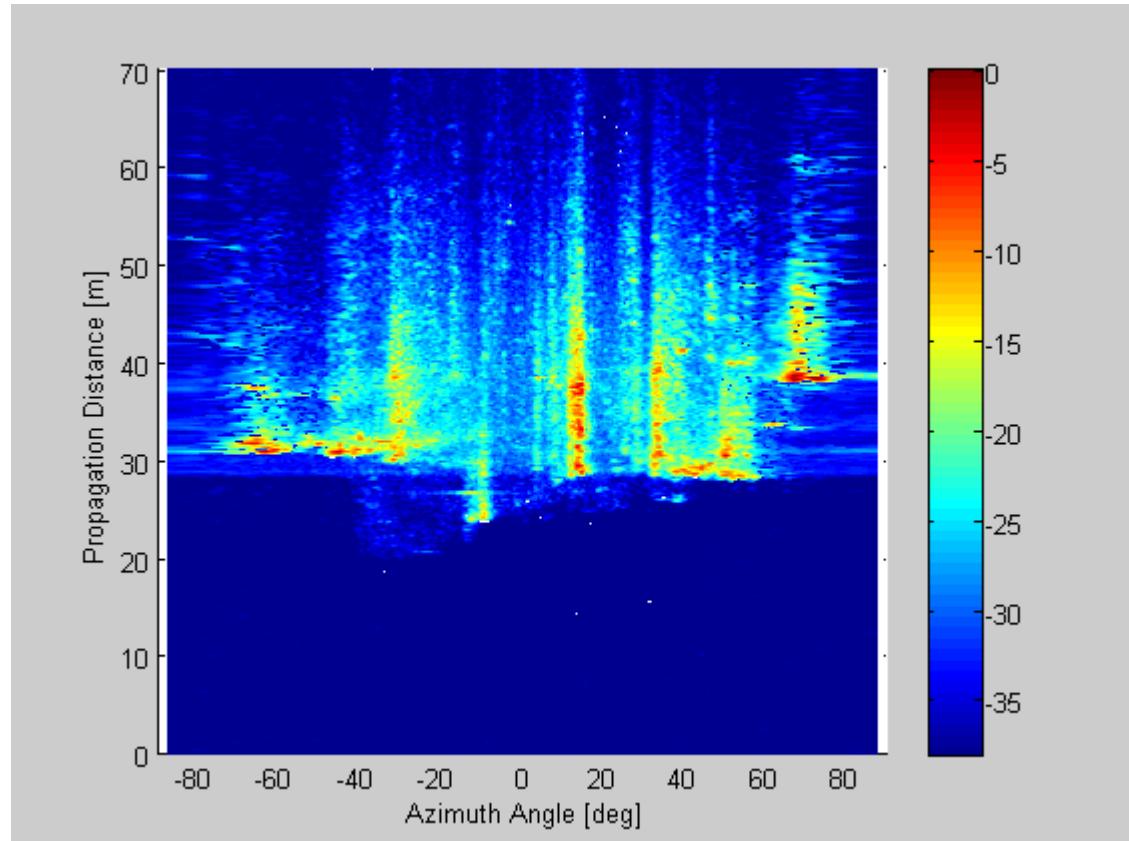
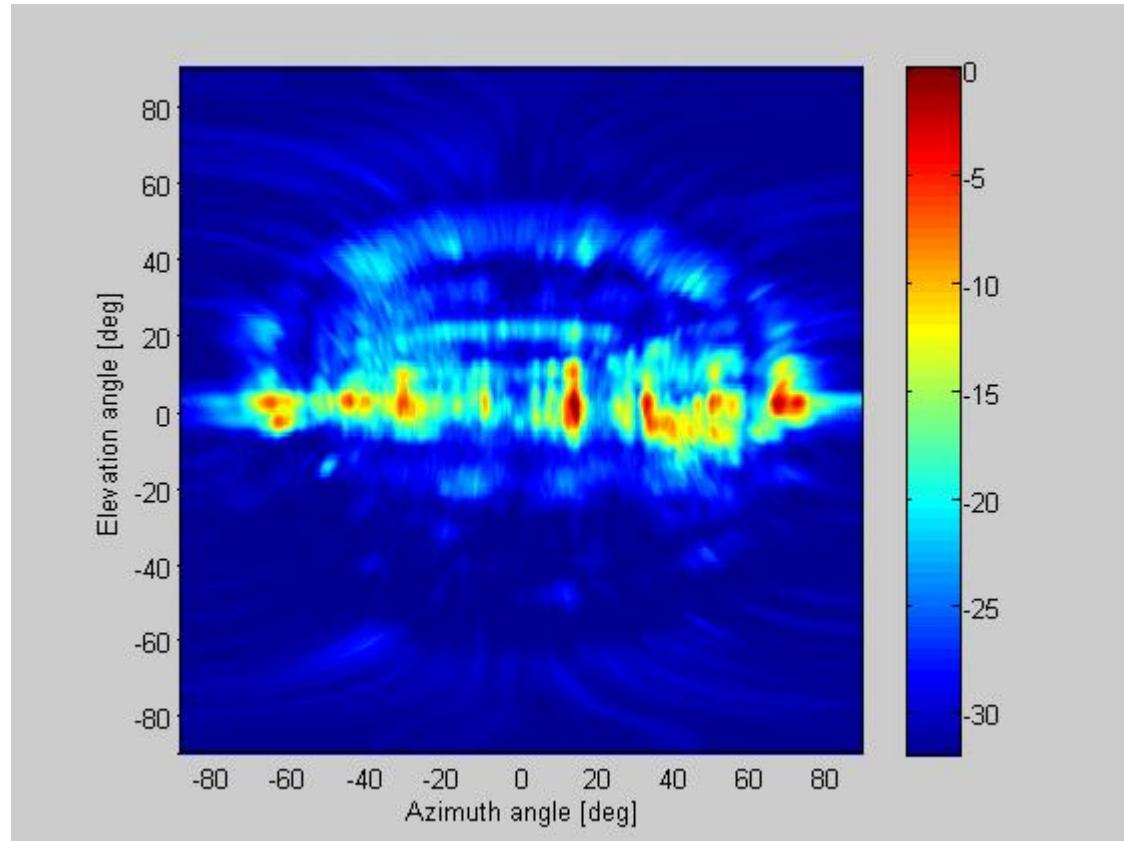
RX3

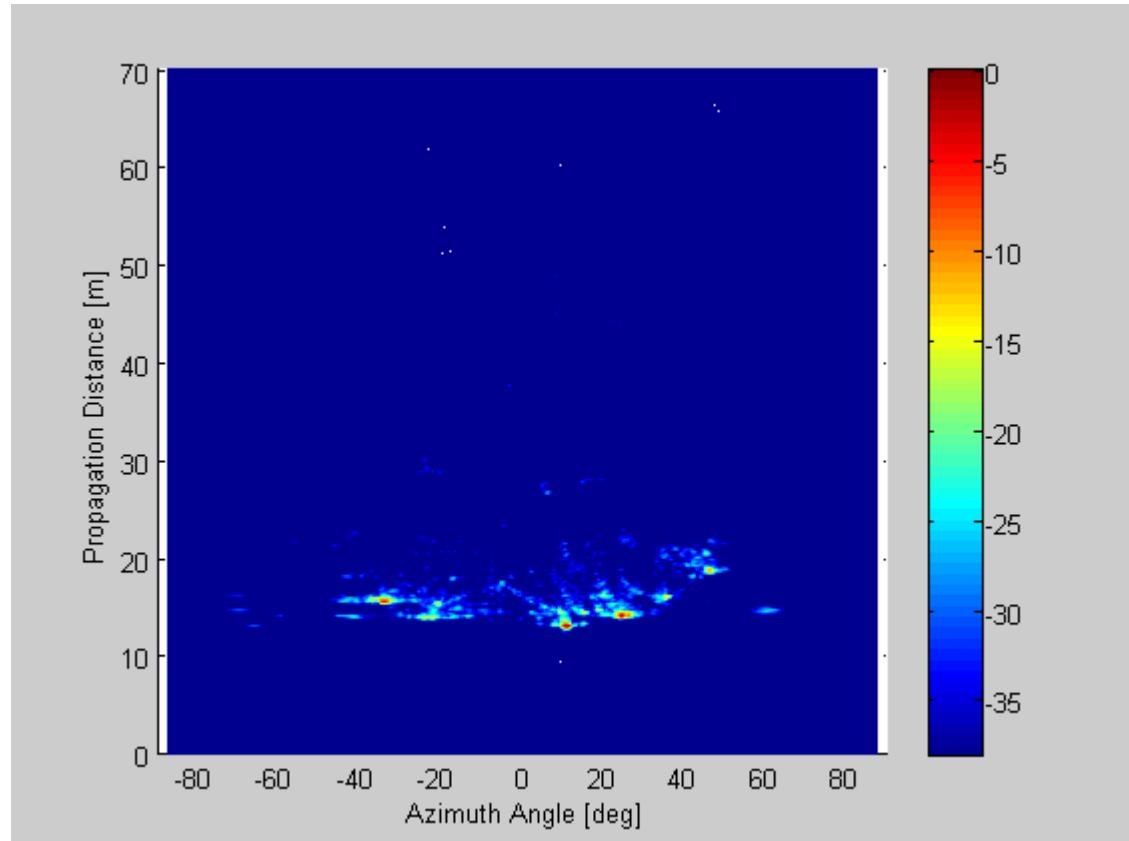
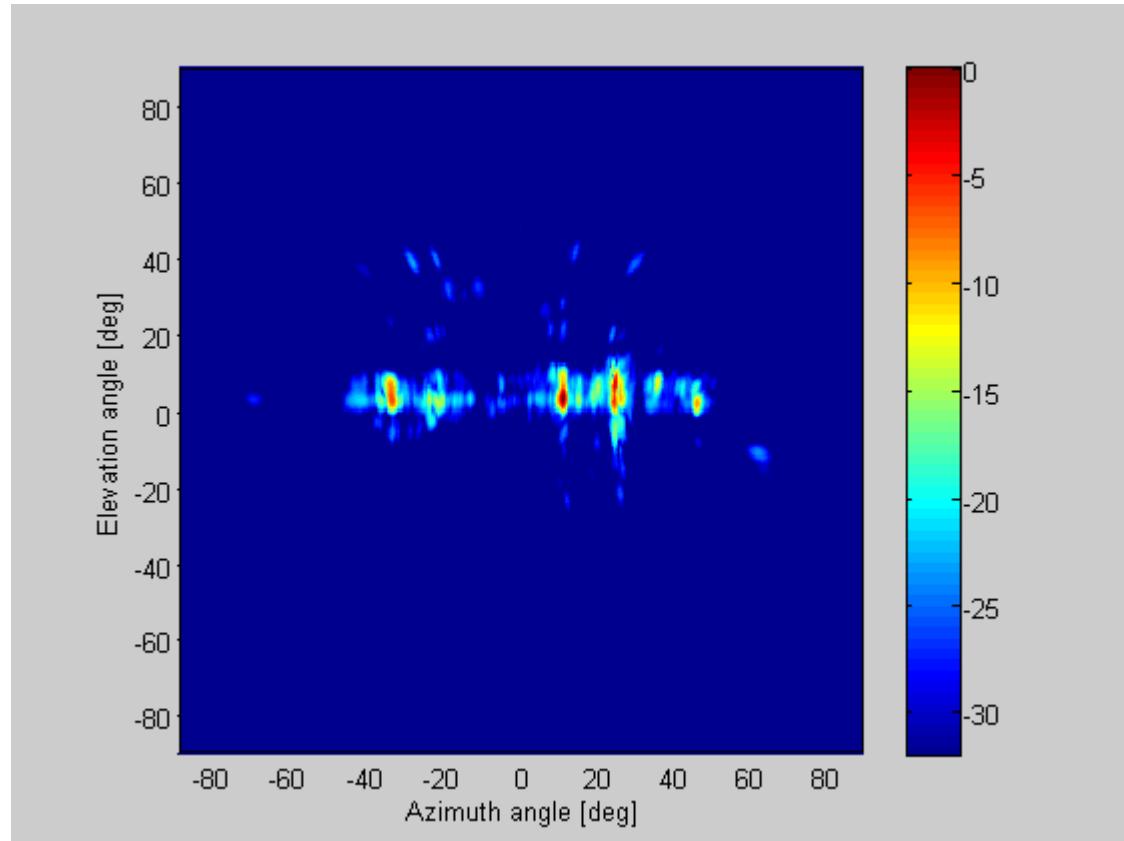


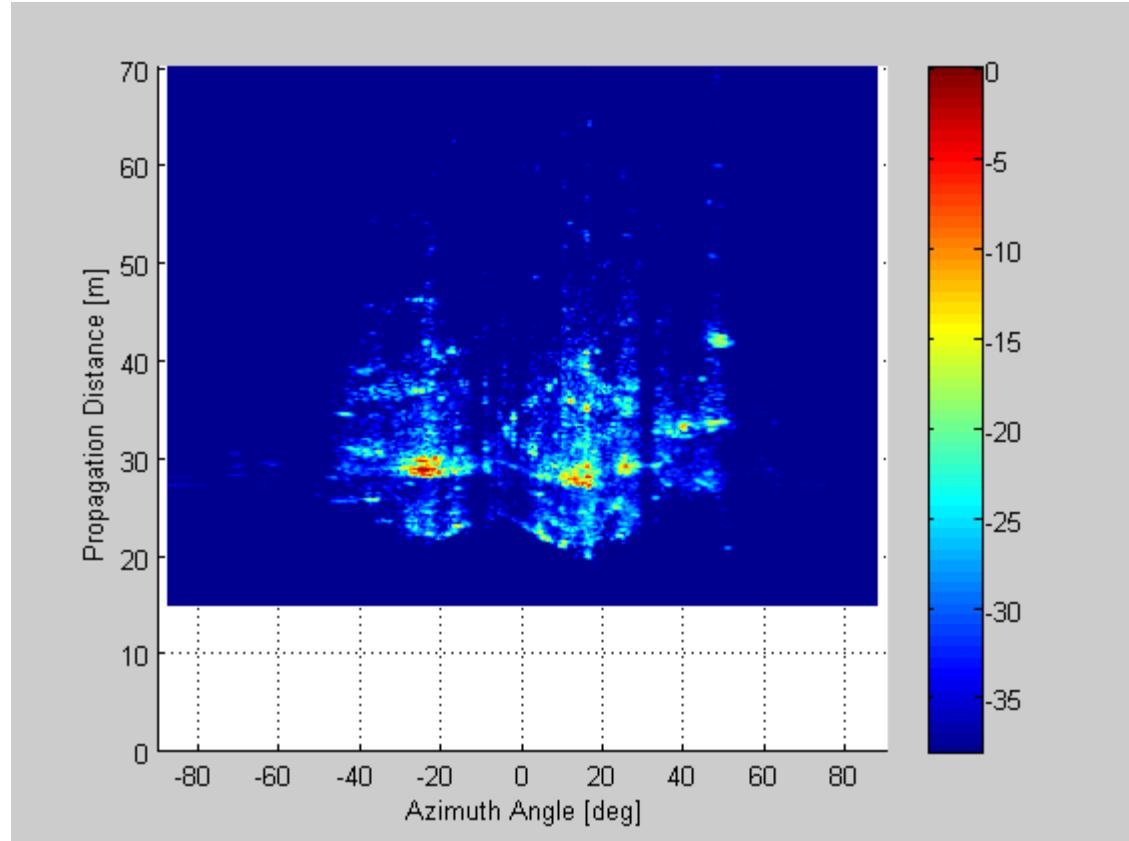
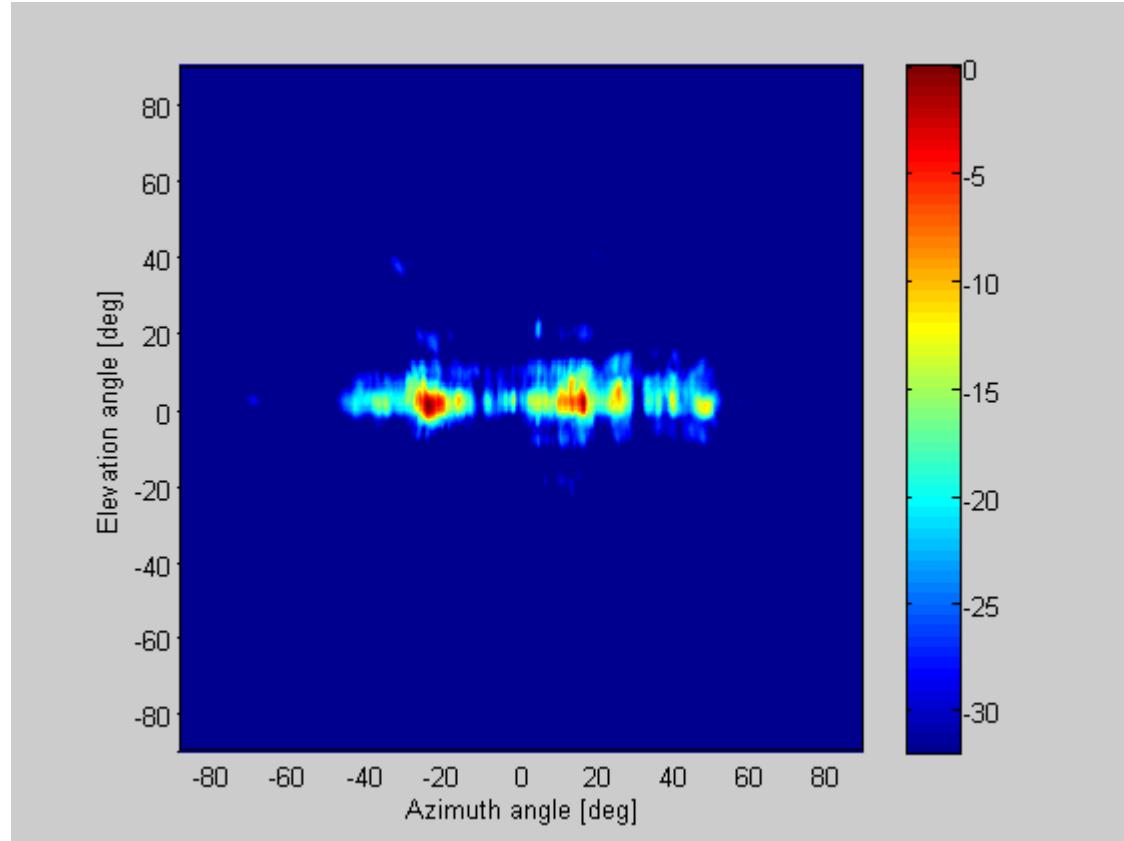
RX4



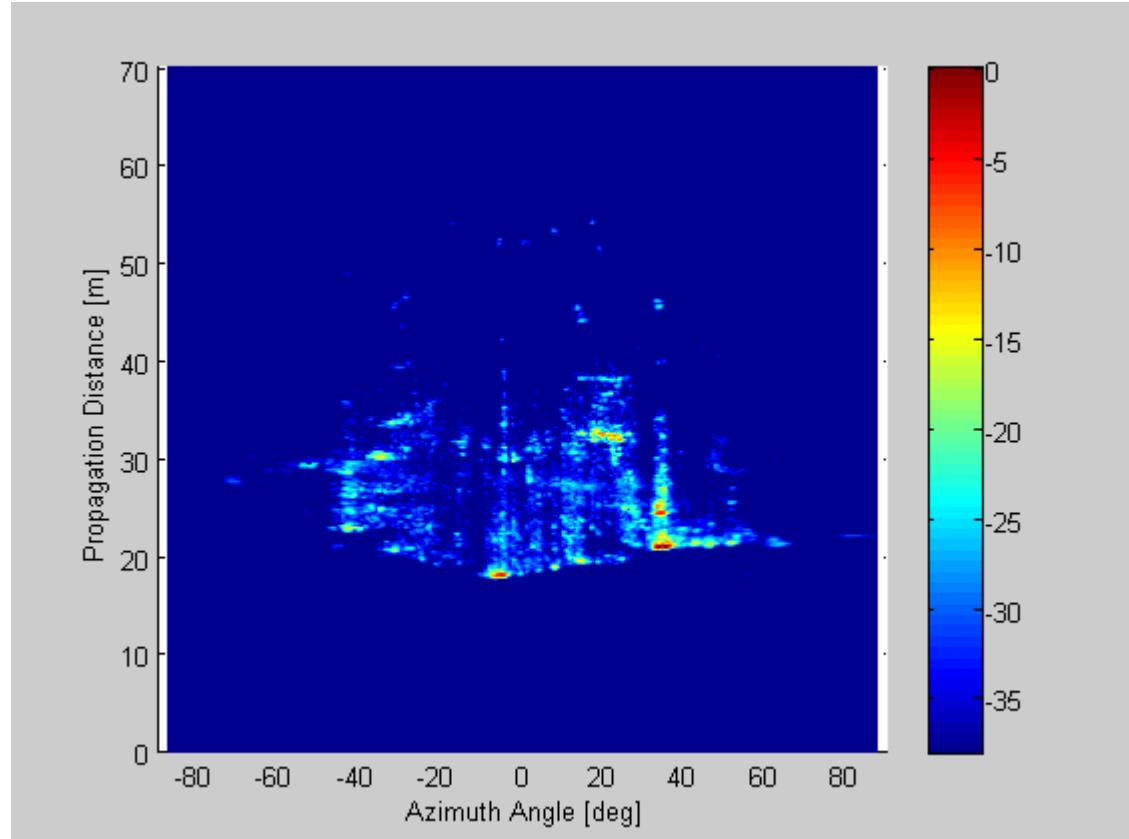
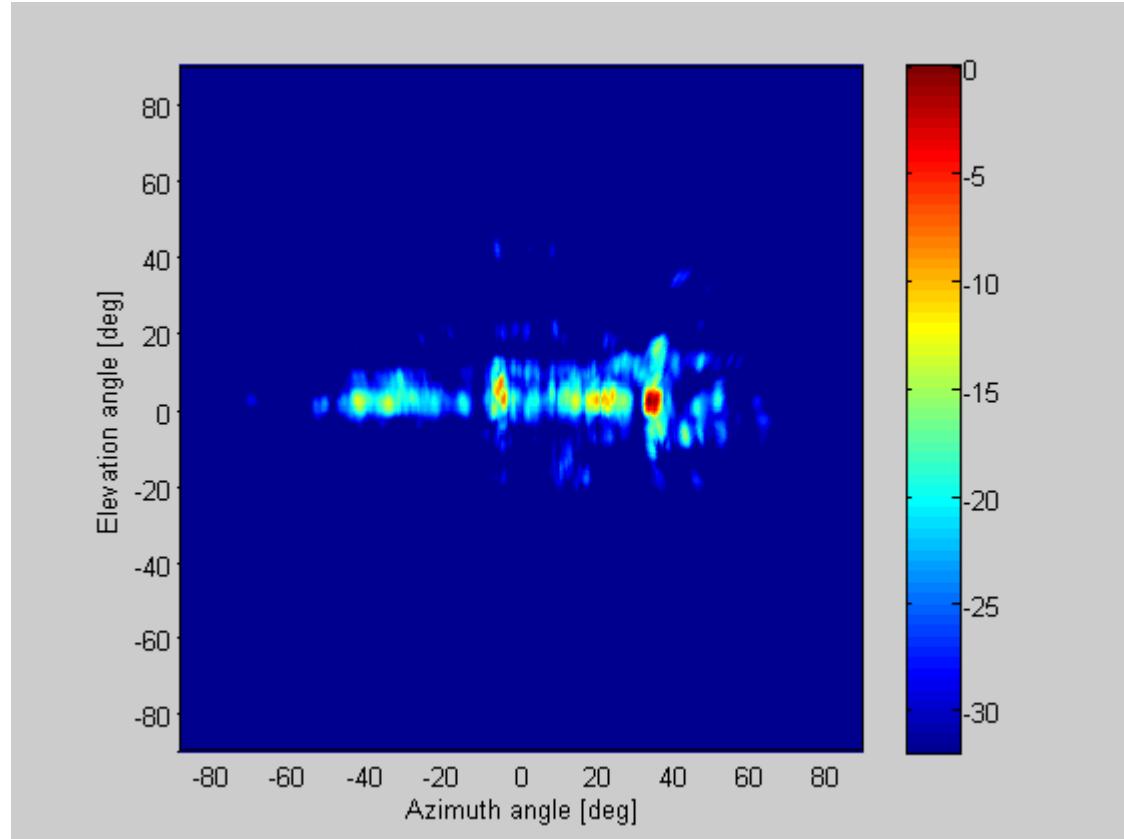
# RX1



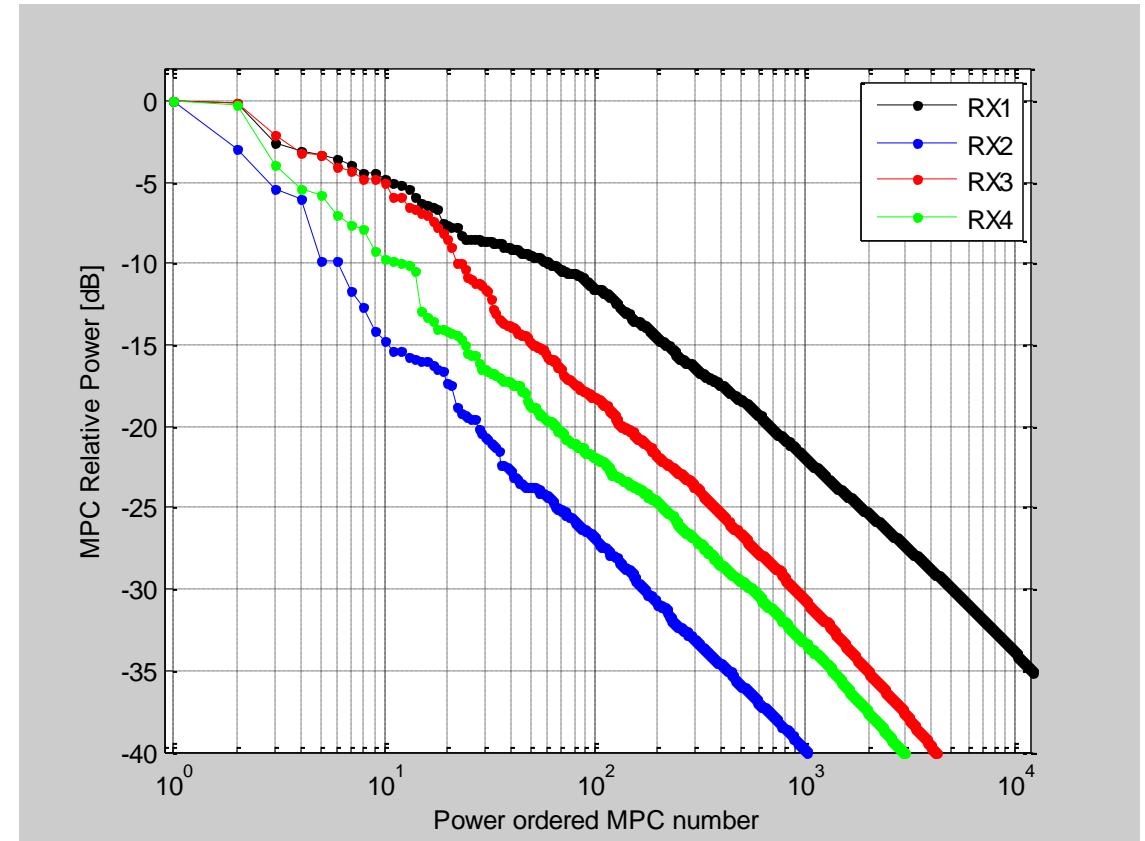
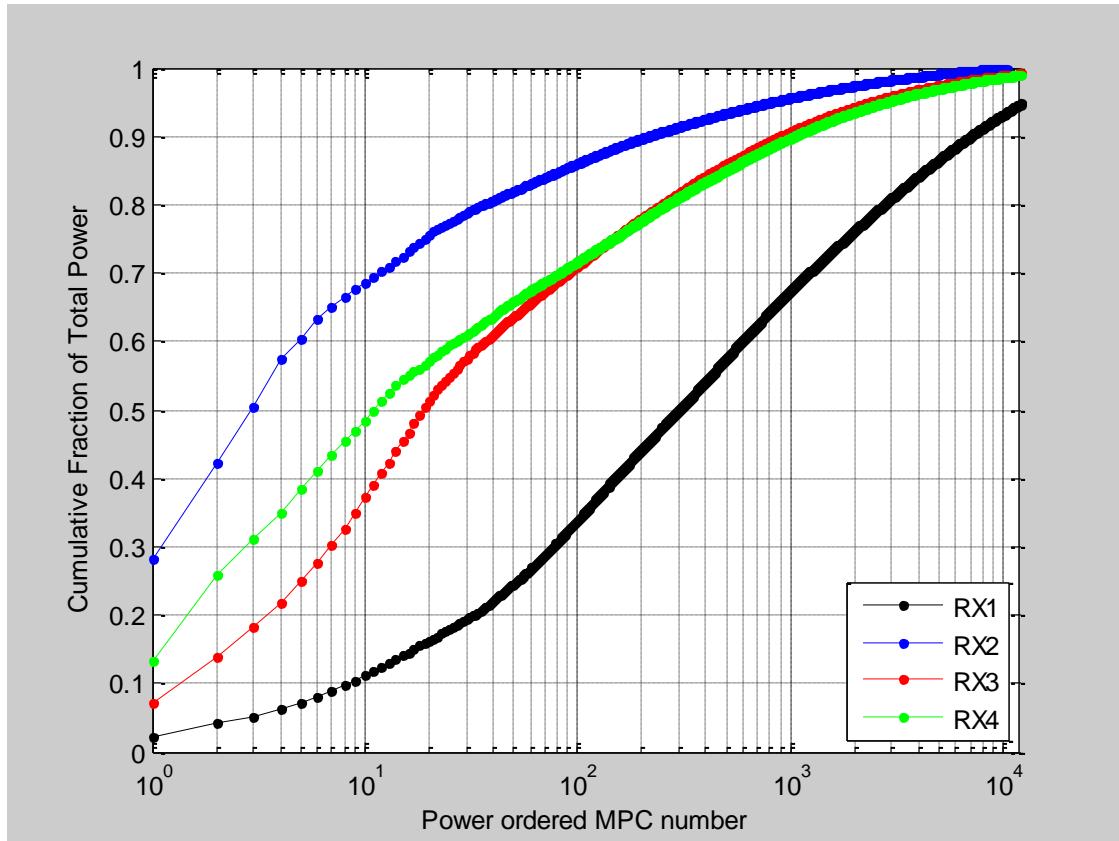




# RX4



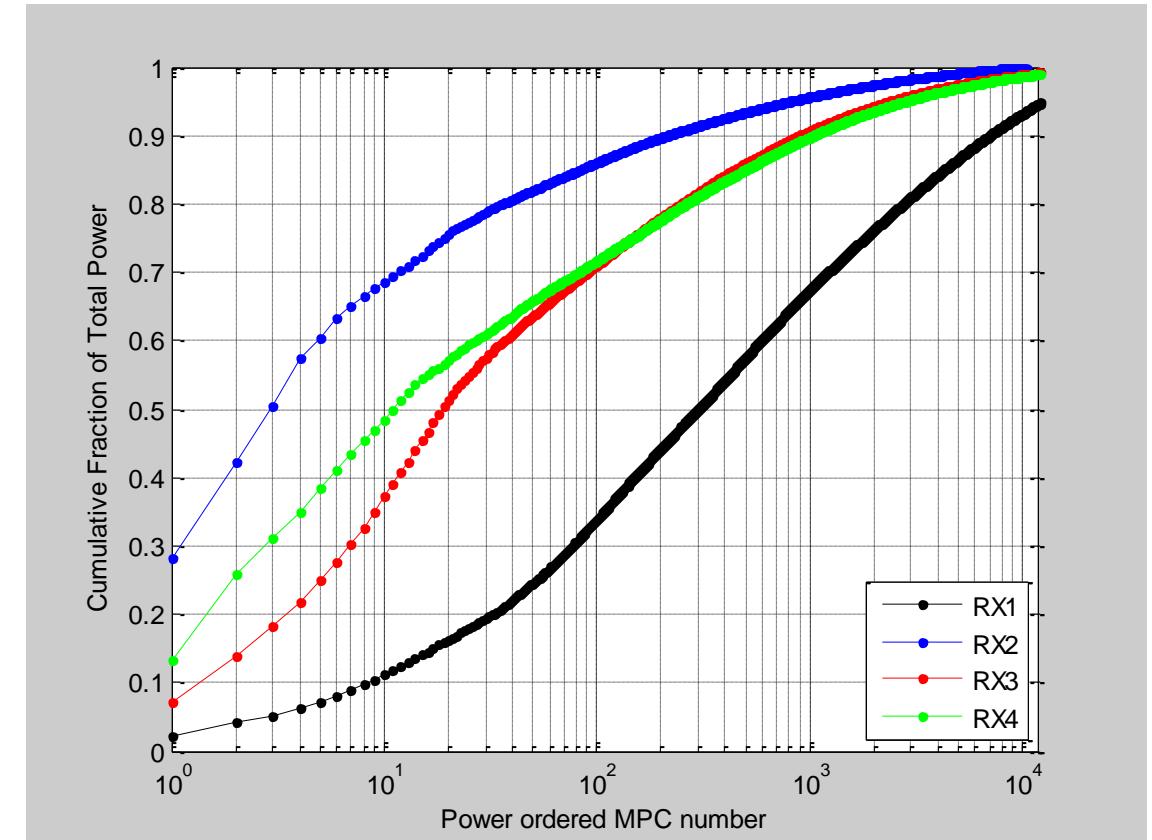
# Multipath Components



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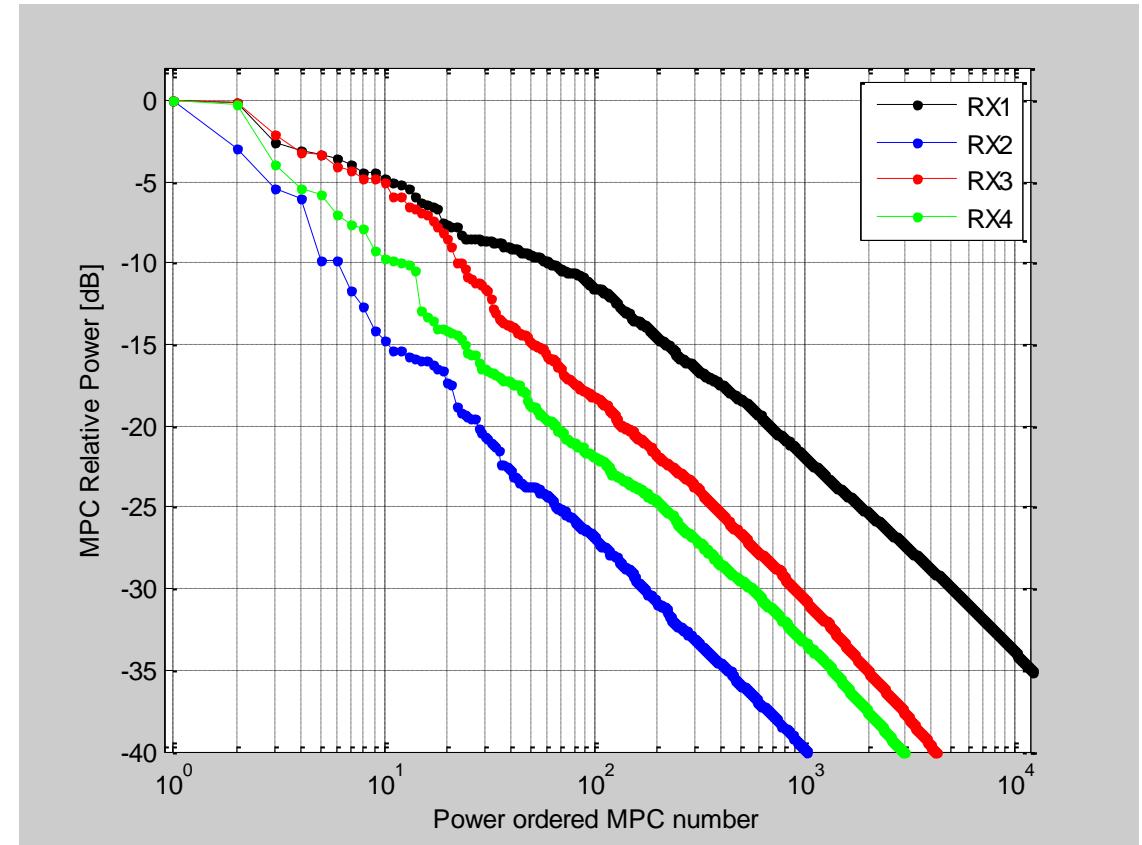
- › Between 1000 and 10000 MPCs needed for 95% of total power
- › The more obstructed scenario the higher number of MPCs needed
  - 1000 needed for LOS (RX2)
- › Strongest MPC accounts for 2-30% of total power
- › 100 strongest MPCs account for 10-70% of total power



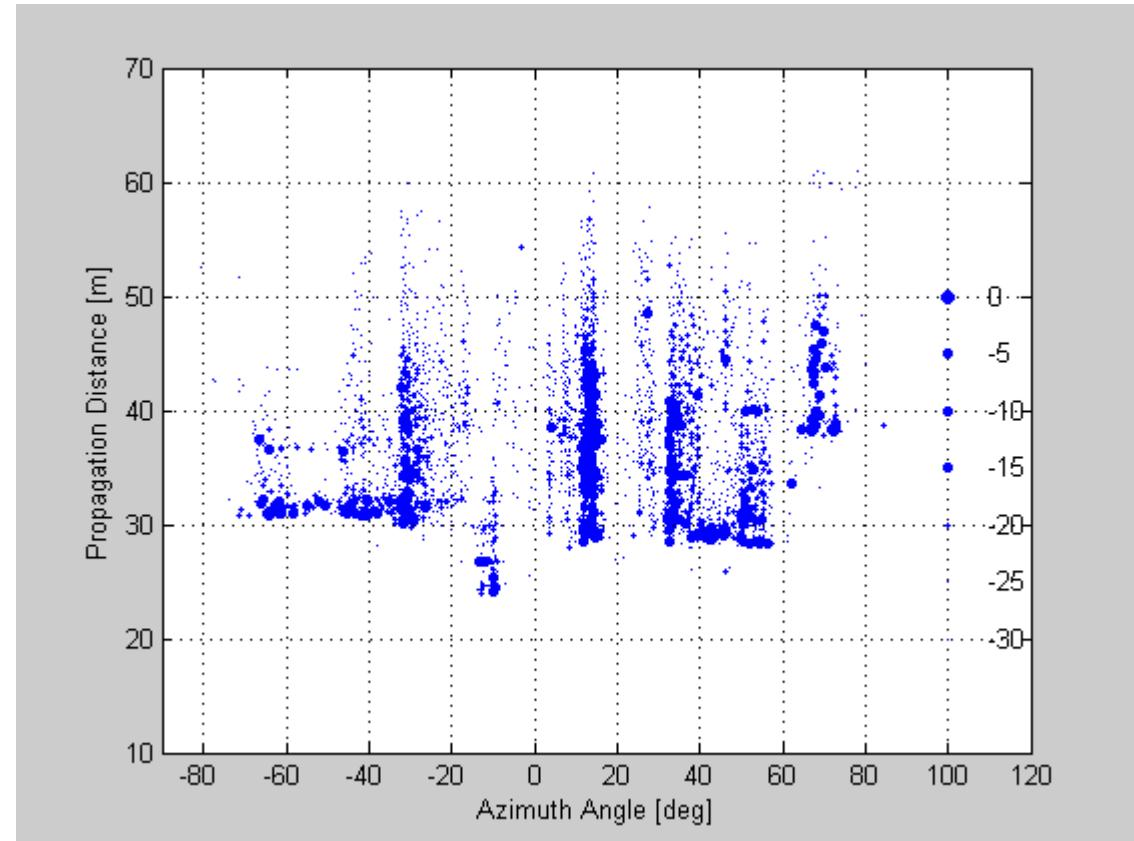
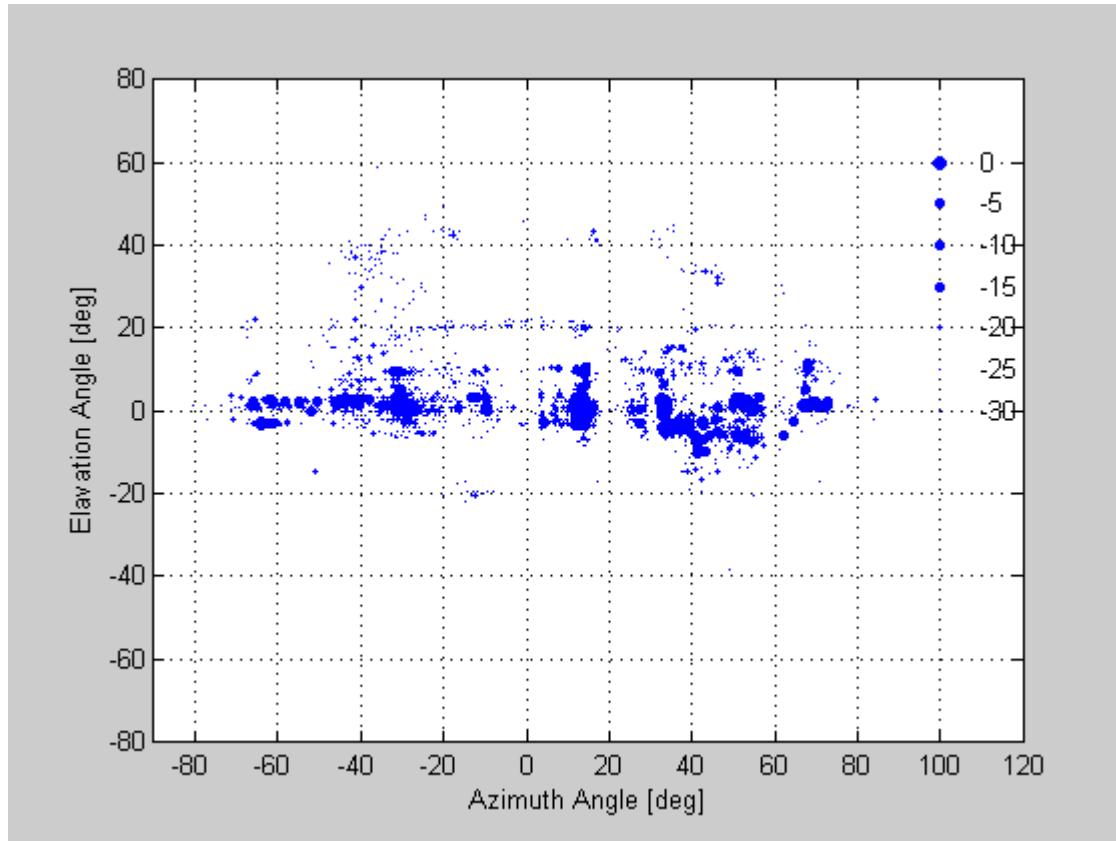
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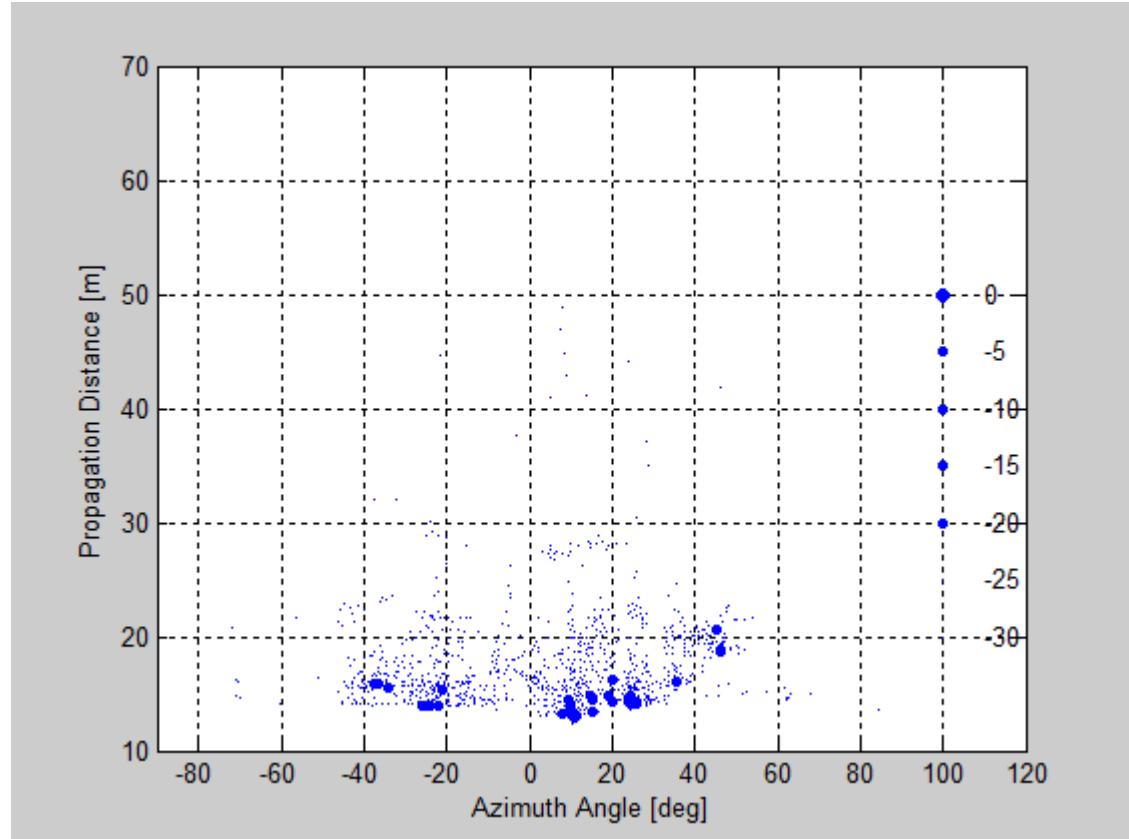
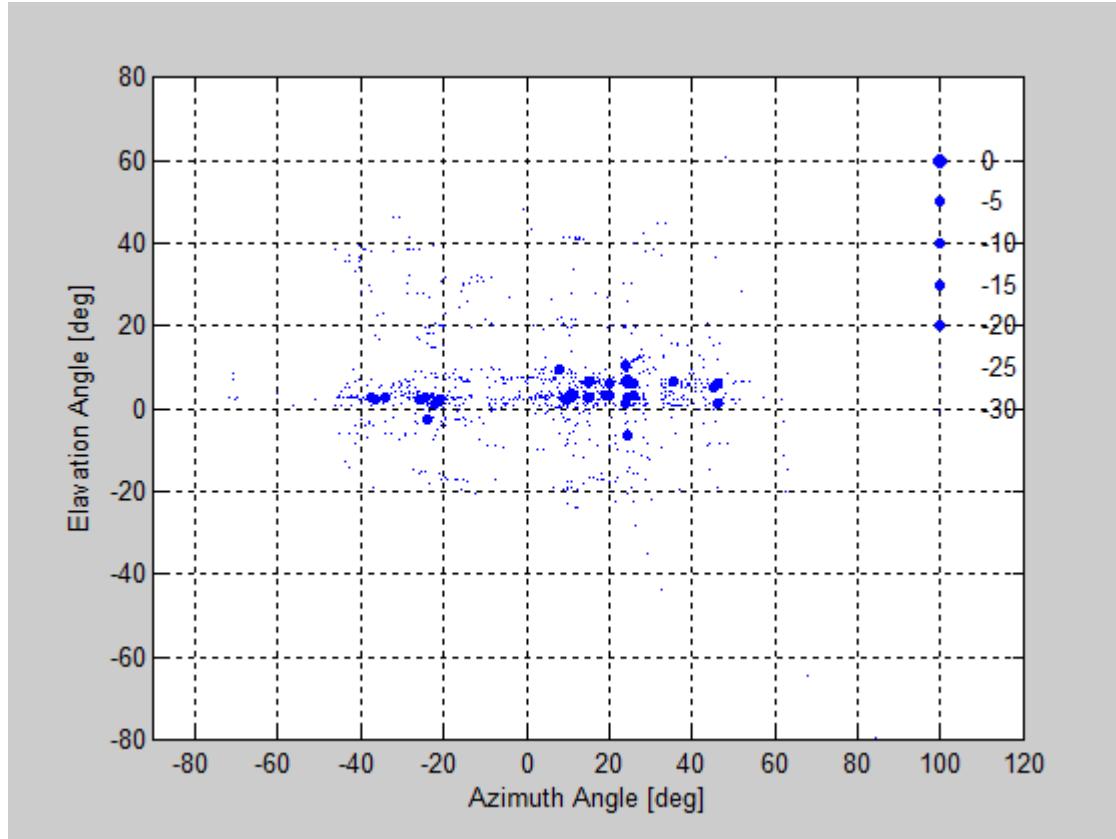
- › Power of MPCs decays about 10 dB per decade of power ordered MPC number
- › Slower decay for obstructed scenarios



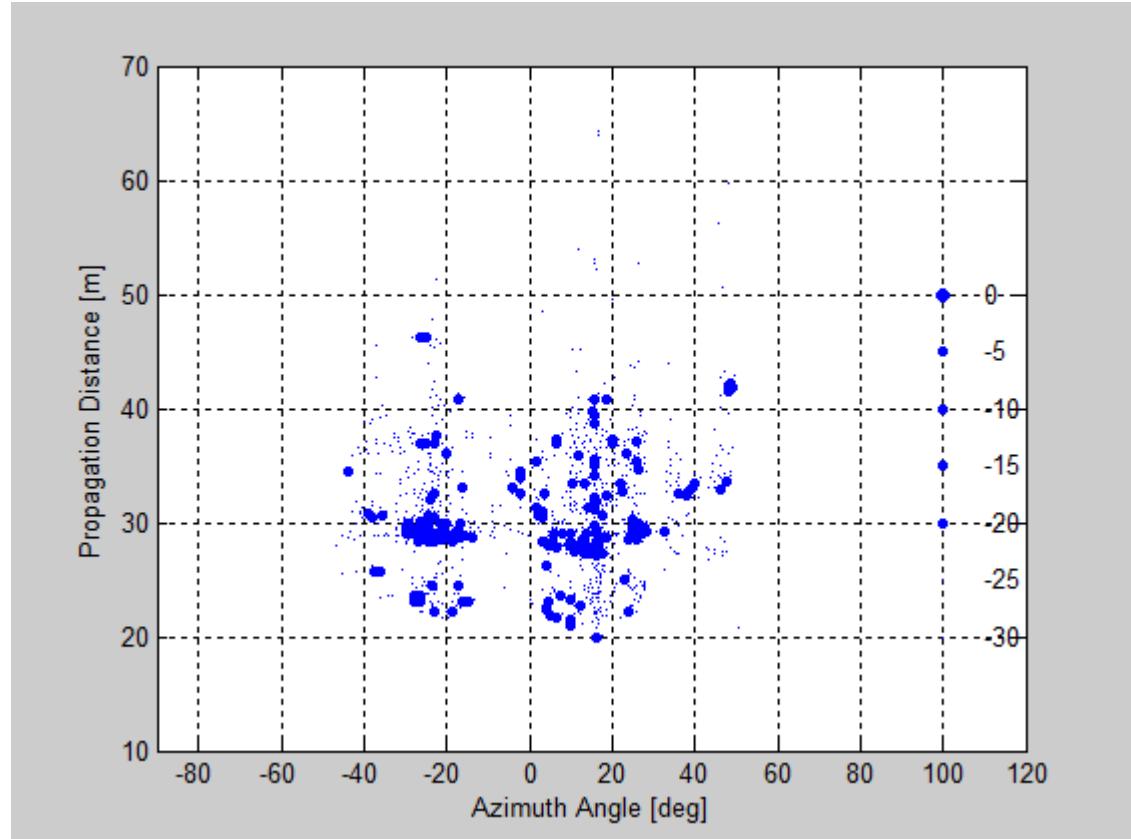
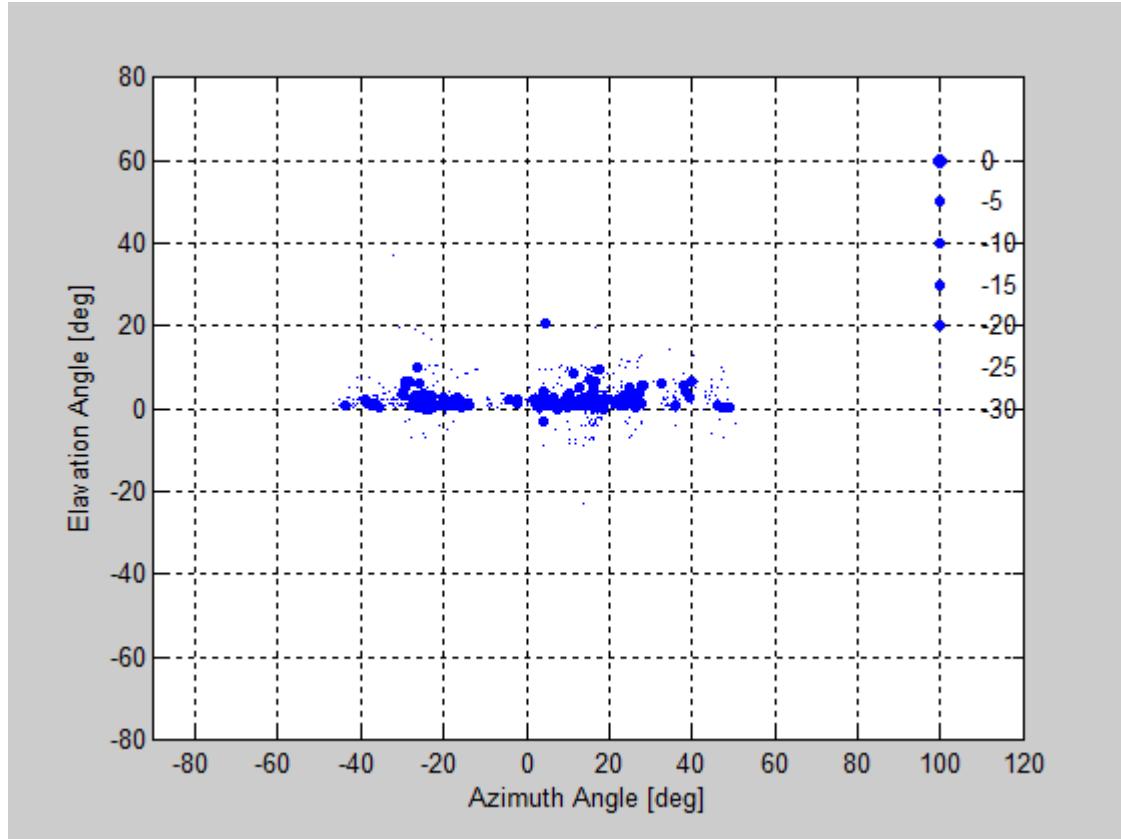
# RX1 Multi Path Components



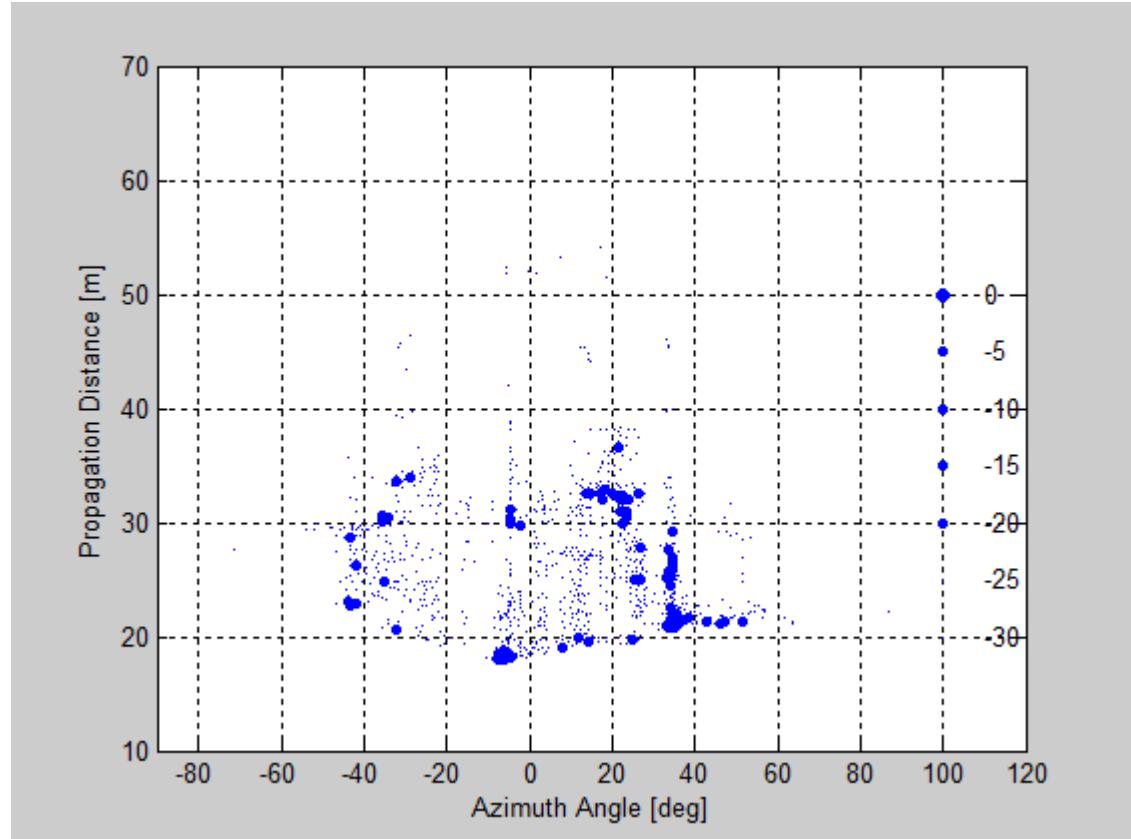
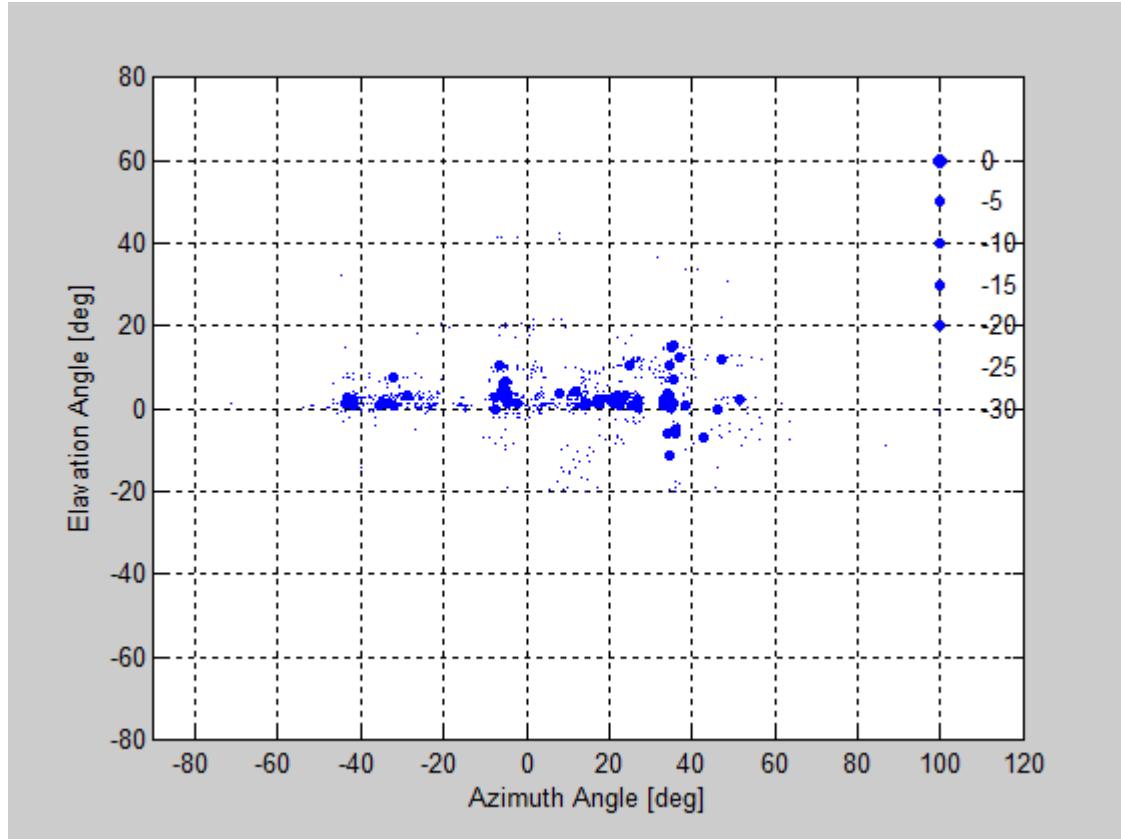
# RX2 Multi Path Components



# RX3 Multi Path Components

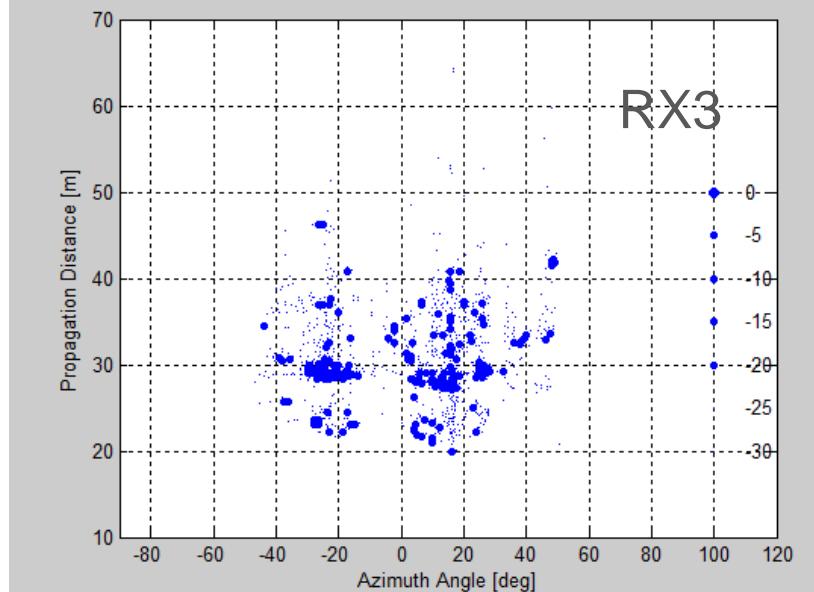
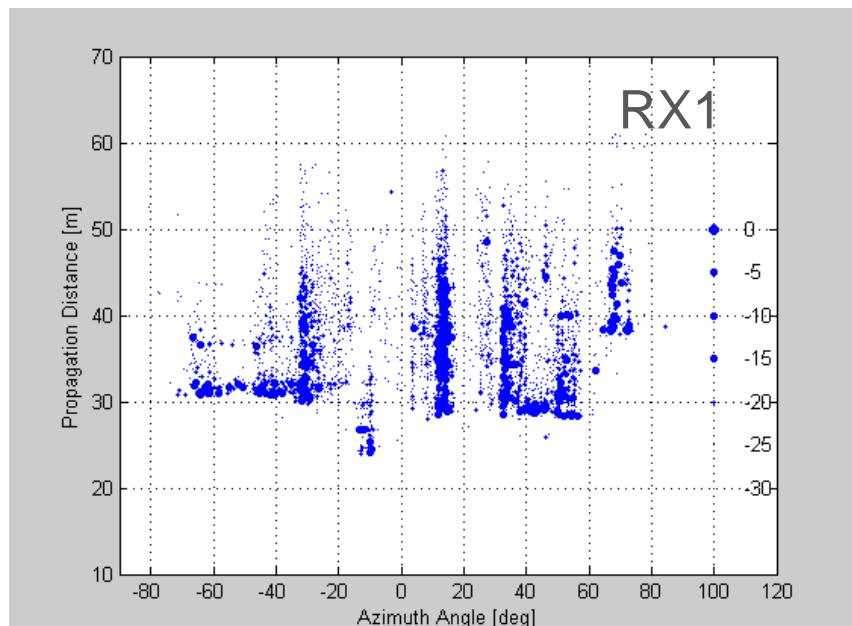


# RX4 Multi Path Components



# RX1 Multi Path Components

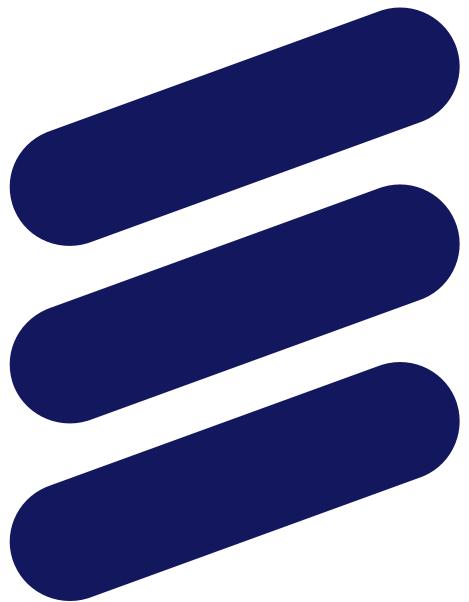
- › RX1 more clustered in angle and spread out in delay
  - Many narrow clusters in angle
  - Heavily obstructed scenario
  - Many clusters in azimuth
  - Clustered also in elevation
- › Other scenarios clustered in both delay and angle
  - Lower number of clusters



# Summary



- › Observation 1: 1000-10000 MPCs needed to account for 95% of power
- › Observation 2: 100 strongest MPCs account for 10-70% of power
- › Observation 3: Number of observed clusters are at the order of 10-20
- › Observation 4: More clusters and MPCs needed in NLOS than in LOS
  
- › Proposal: The observations in this contribution are taken into account when deciding on the number of clusters and paths within clusters



**ERICSSON**