Diversity Combining and Interference Rejection Performance Comparison between Linear and Square arrays of Low-Profile Monopole elements

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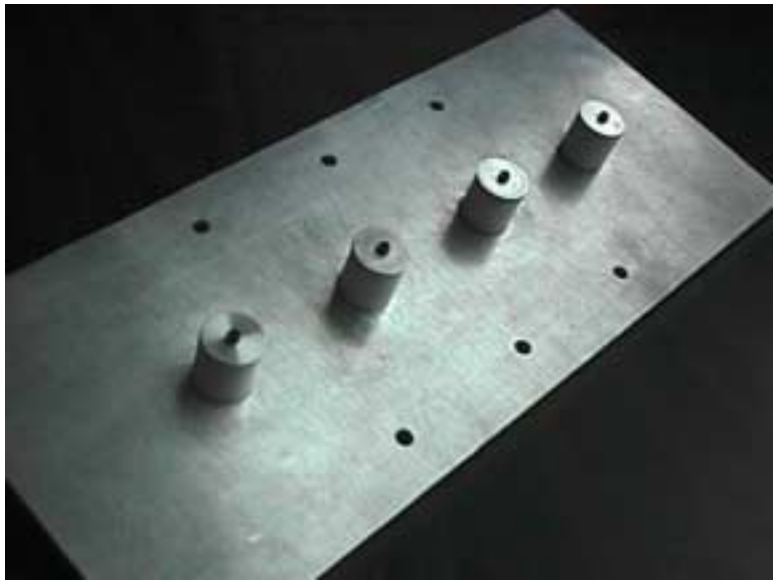
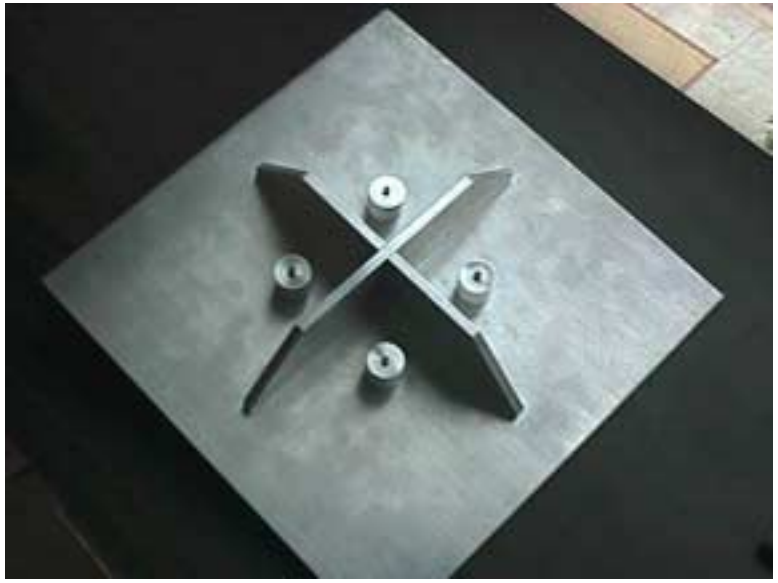
Antenna Arrays with Low-Profile Broadband Monopole Elements



Linear Array

Square Array



Sectorized Square Array

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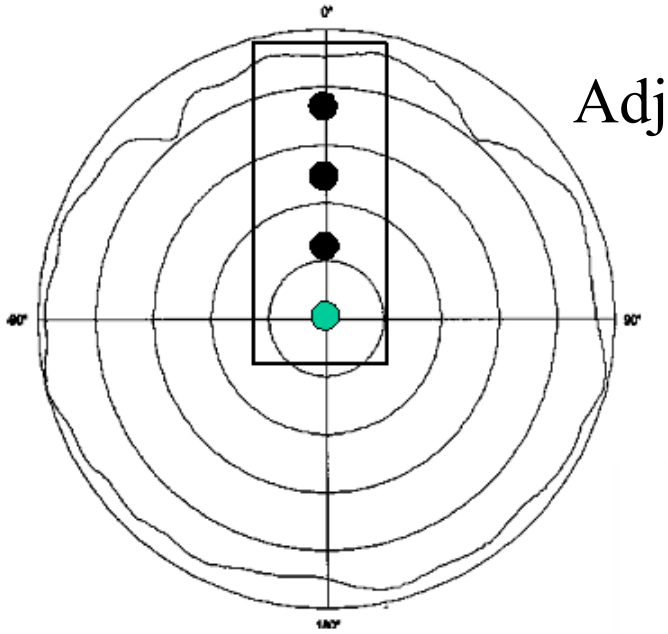
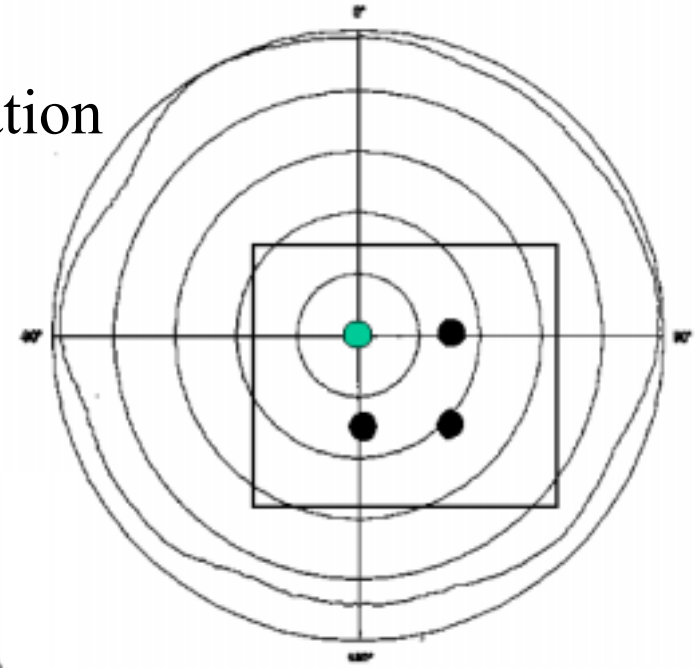
Co-Polarized H-plane Active element patterns at 2.05 GHz



Adjacent element separation is $\lambda/2 = 0.146$ m

Scale = 10 dB/division

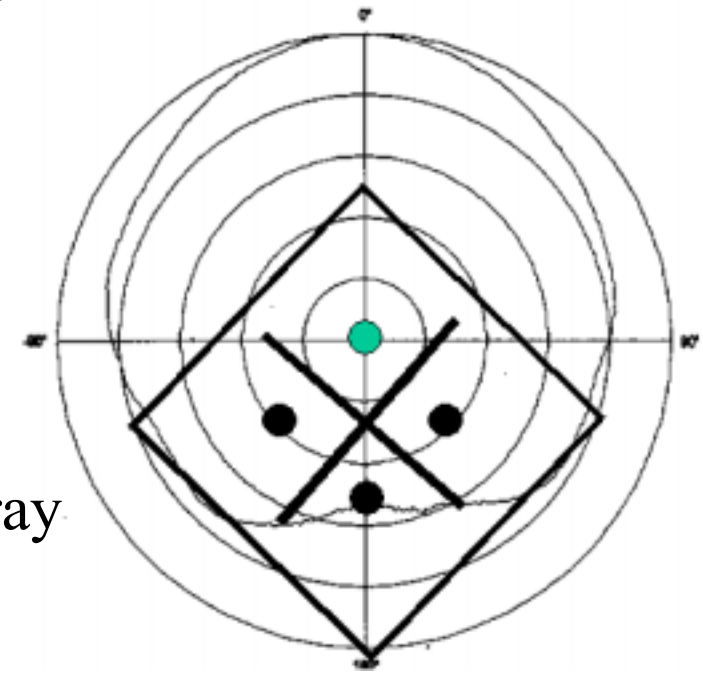


Linear Array

Reference element gain

Square Array

Rel. gain = - 3.1 dB



Sectorized Square Array

Rel. gain = + 3.7 dB

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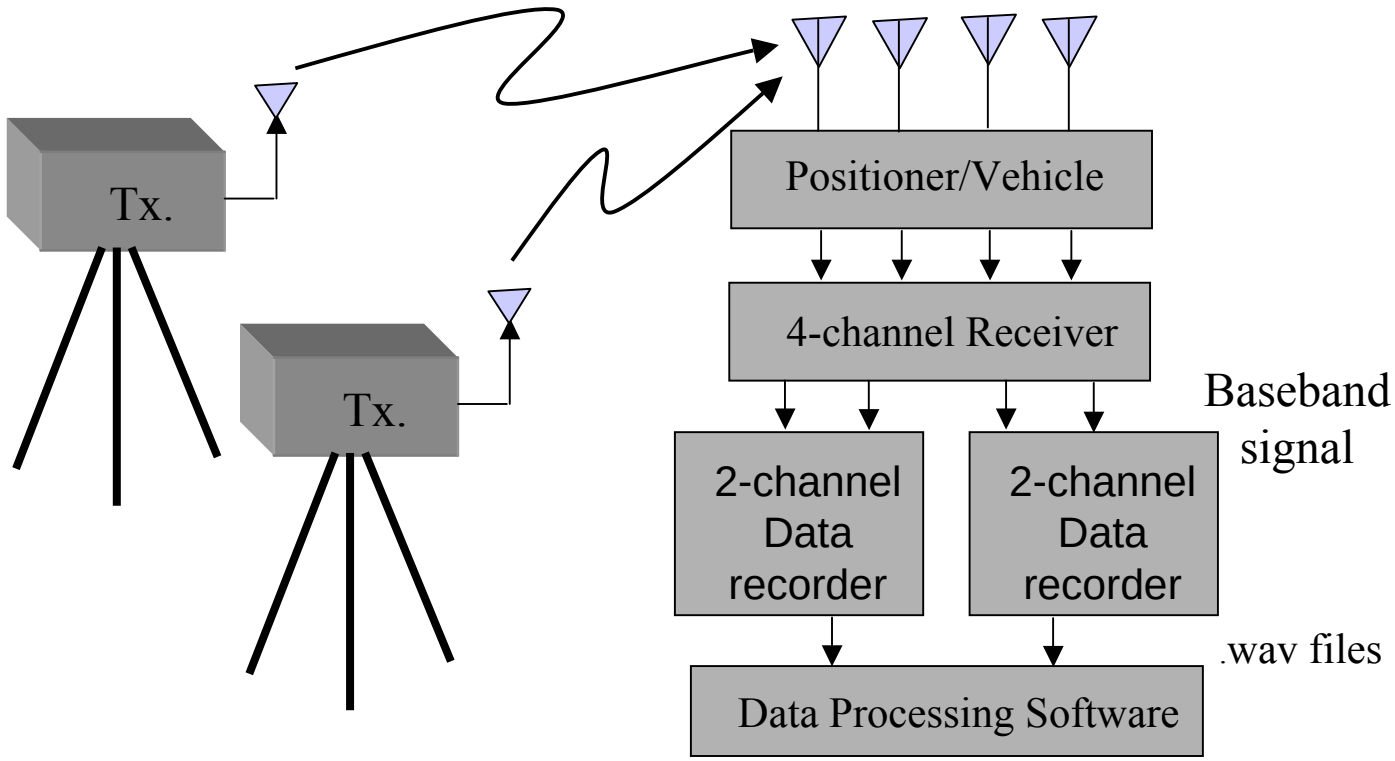
Handheld Antenna Array Testbed (HAAT)



- 4-channel Narrowband Receiver at 2.05 GHz
- Arrays mounted on Linear Positioner/Vehicle Roof-top
- Offline processing of the data collected

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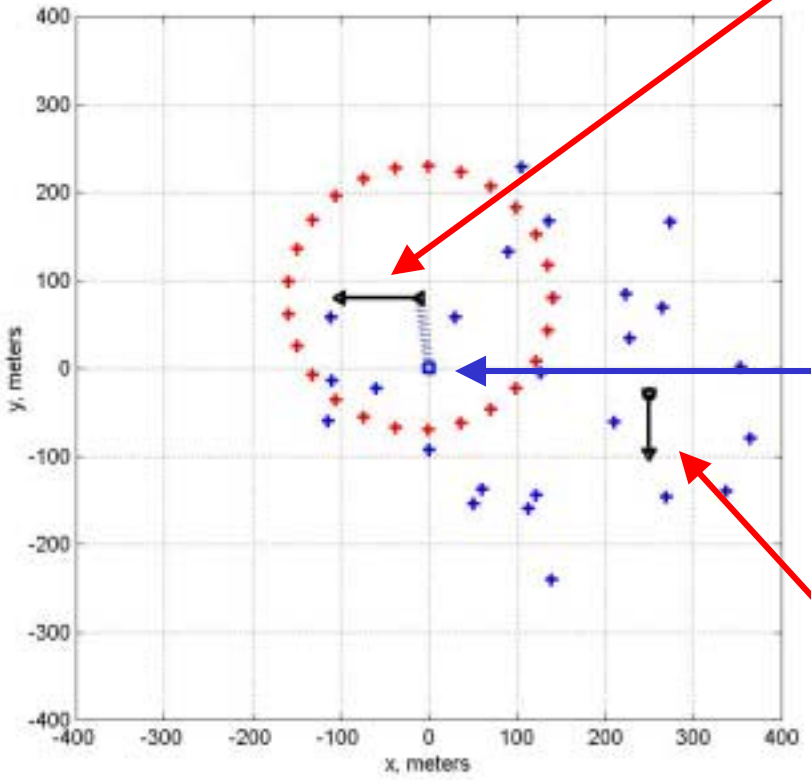
Simulation Geometry and Measurement Scenario



LOS Condition (Lee's Model)

Transmitter

NLOS Condition (Liberti's Model)

Simulation Tool : Vector Multipath Propagation Simulator (VMPS)

Measurement System: Handheld Antenna Array Testbed (HAAT)

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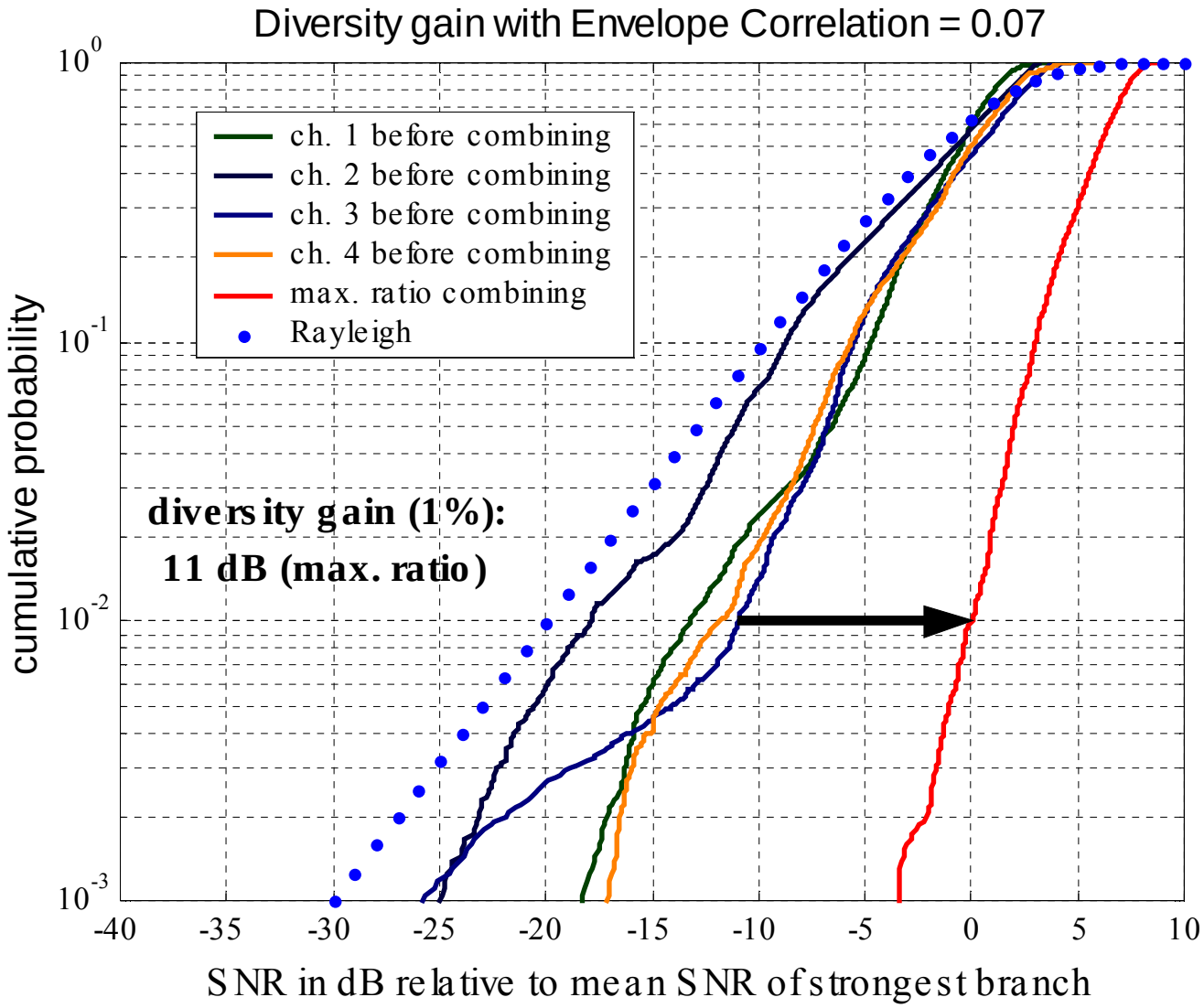
Diversity Gain



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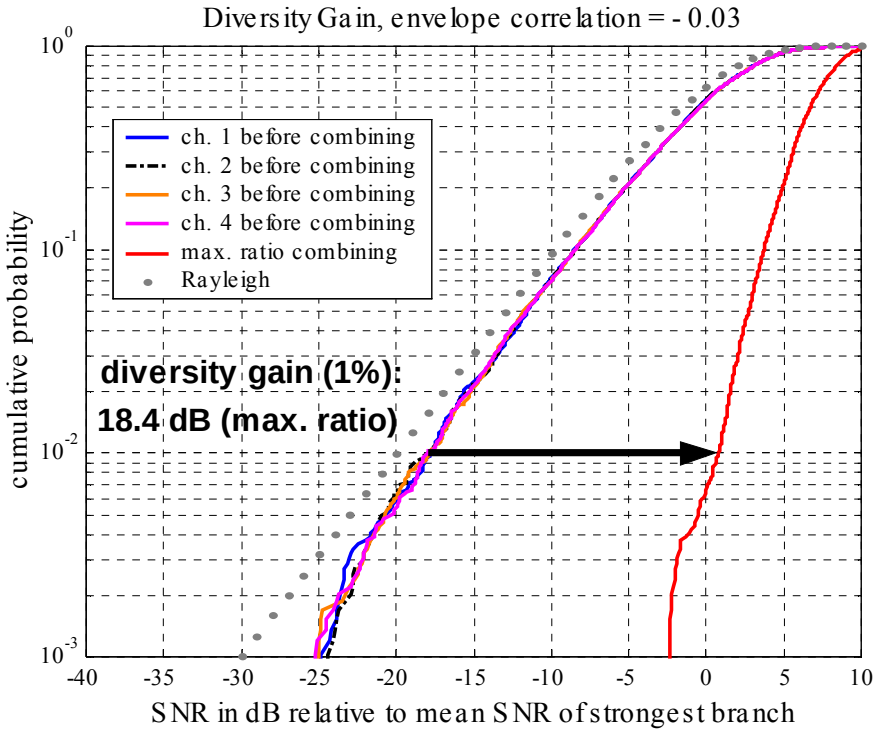
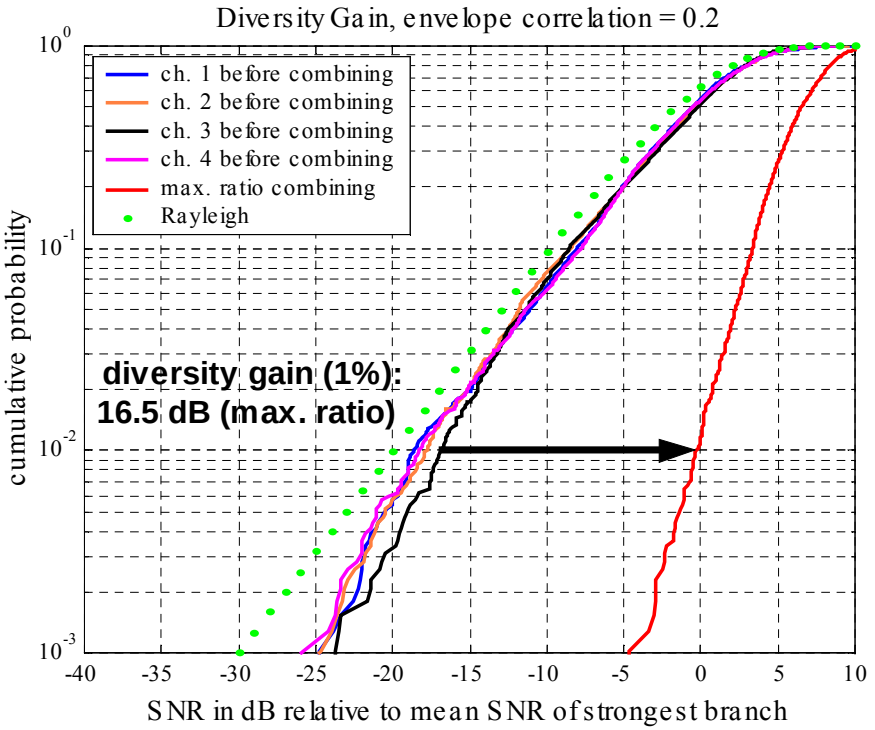
Simulated Suburban Non-Line-of- Sight Diversity Results





Linear Array

G_{div} [1%] = 18.4 dB

Square Array

G_{div} [1%] = 16.5 dB

Maximal Ratio Combining (MRC) with Liberti Scatterer Model

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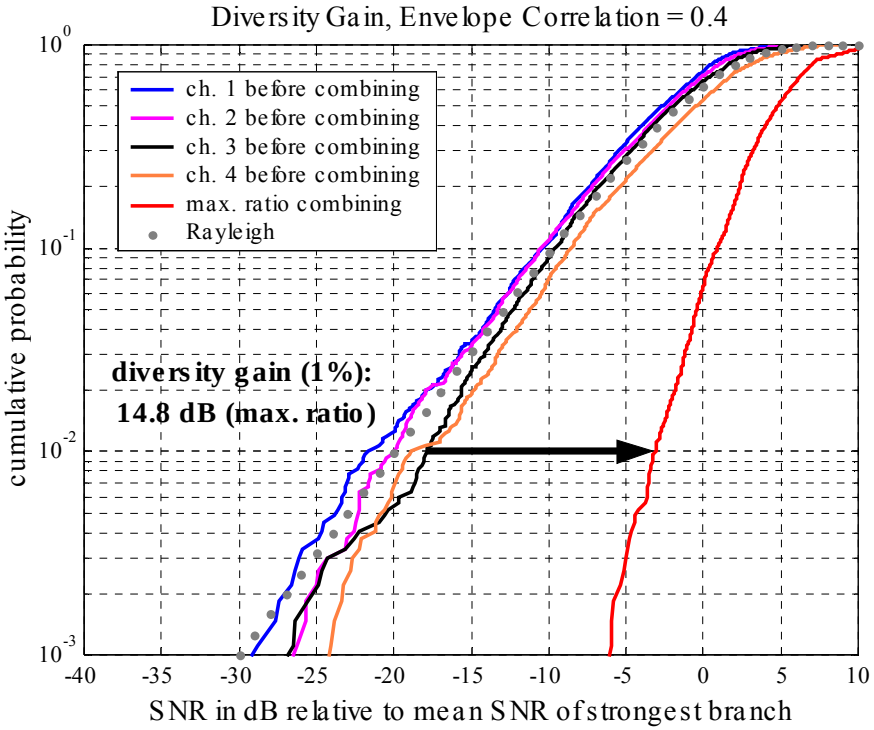
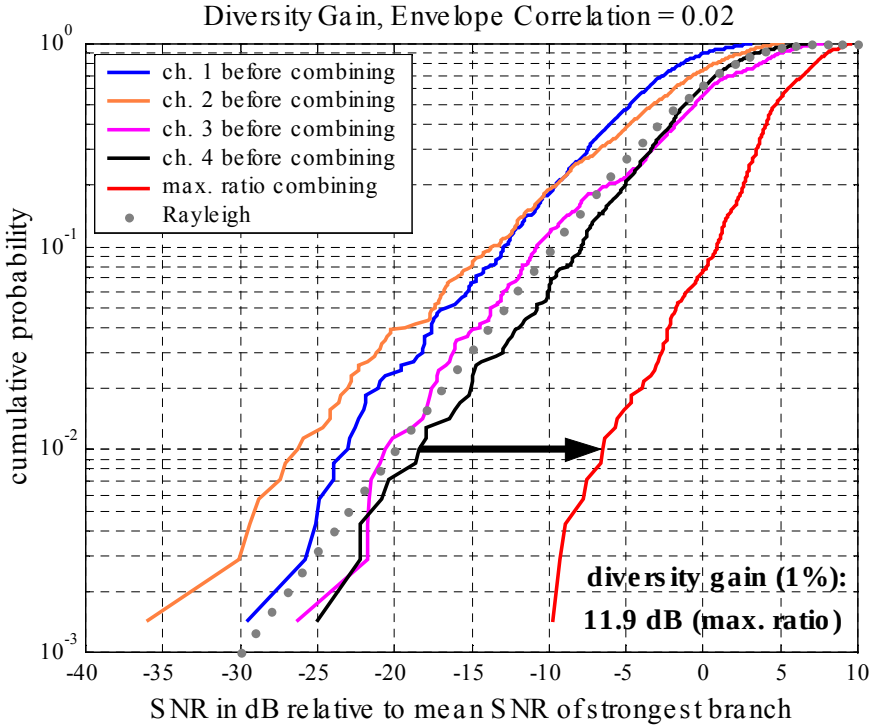
Measured Suburban Non-Line-of-Sight Diversity Results



Linear Array

G_{div} [1%] = 14.8 dB



Square Array

G_{div} [1%] = 11.9 dB

Maximal Ratio Combining (MRC)

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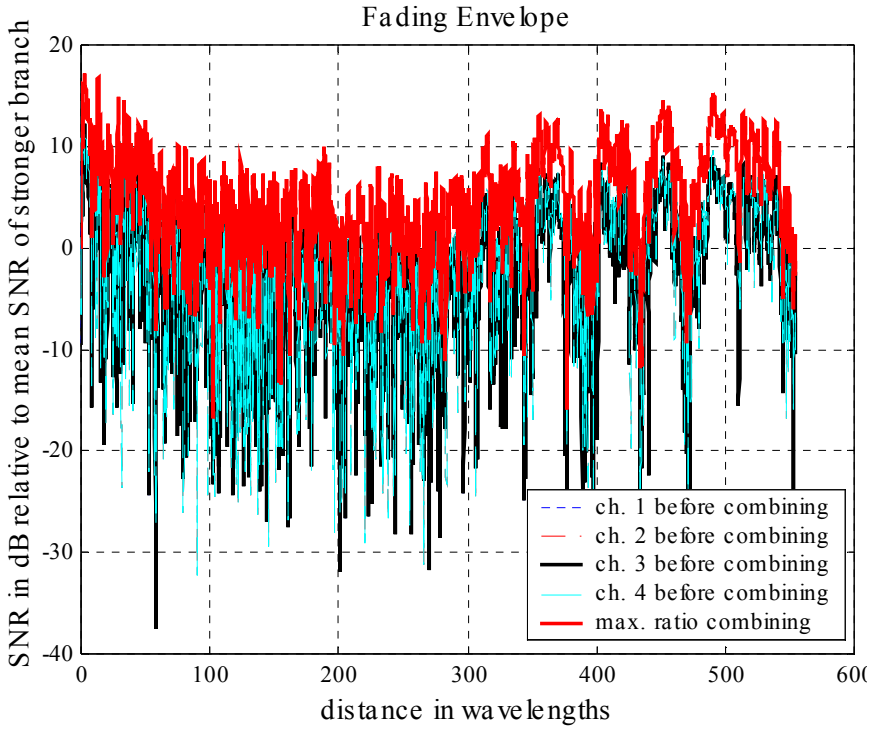
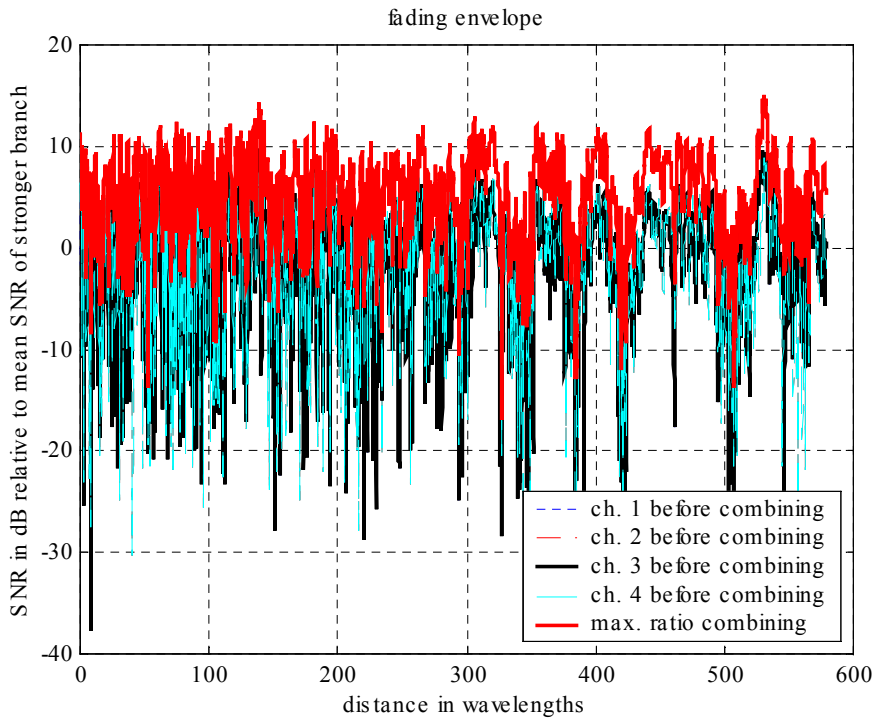
Effect of Demeaning for Vehicular Measurements





Fading Envelope without demeaning

$G_{div}(1\%) = 12.9$ dB

Fading Envelope with demeaning

$G_{div}(1\%) = 12.3$ dB

Demeaning Window = 100 wavelengths

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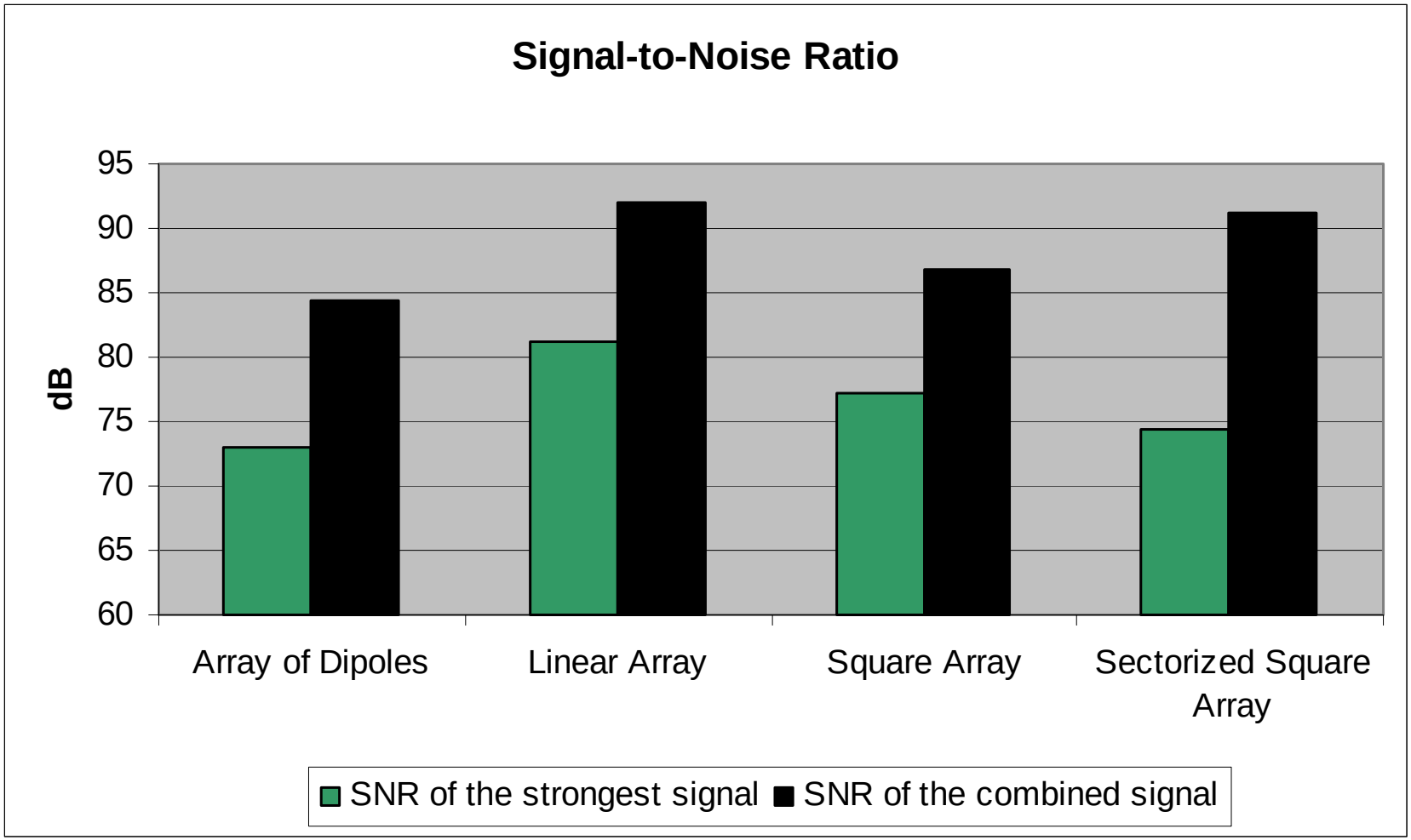
Diversity Performance in Suburban LOS for Arrays mounted on a vehicle roof-top



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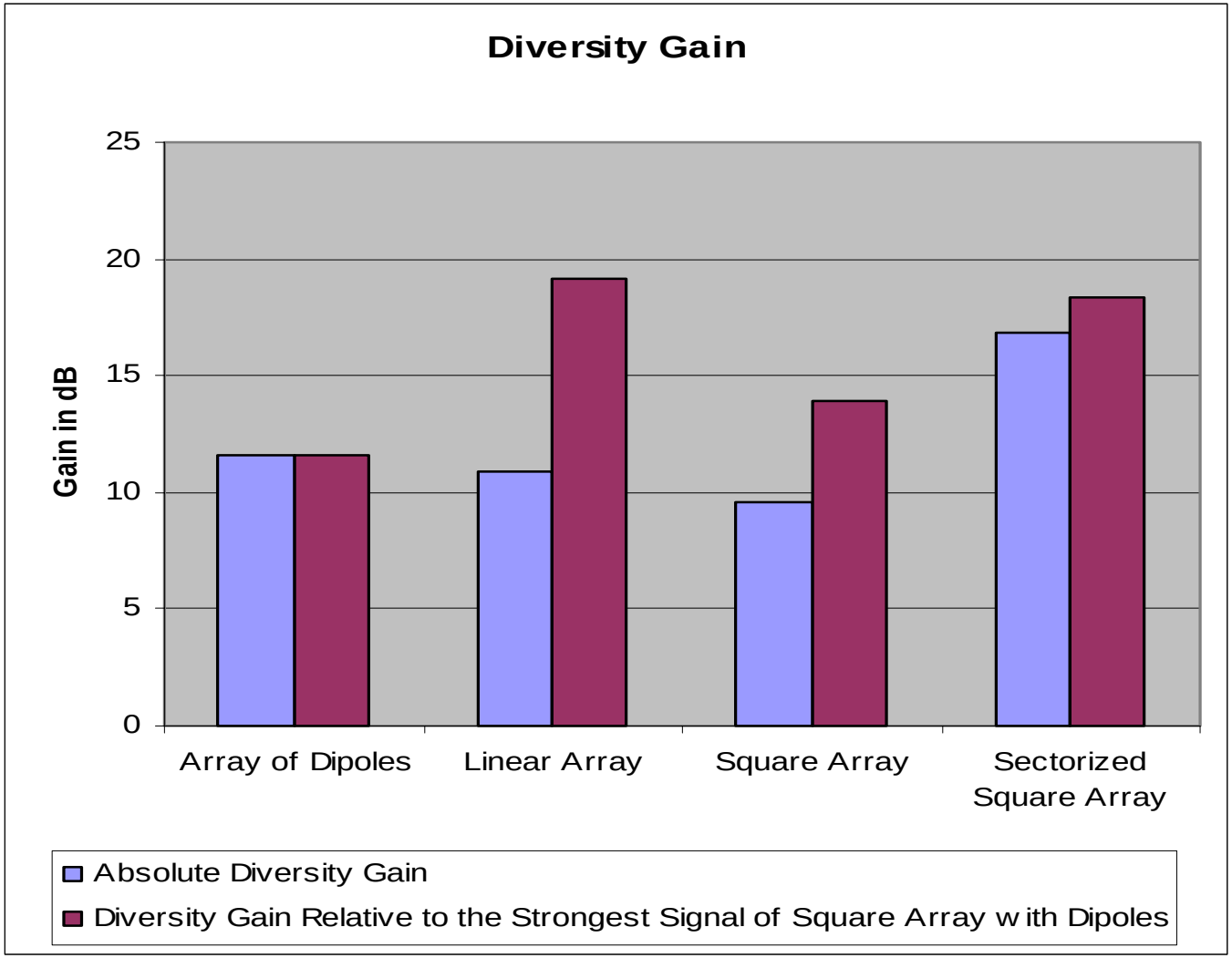
Diversity Performance in Suburban LOS for Arrays mounted on a vehicle roof-top



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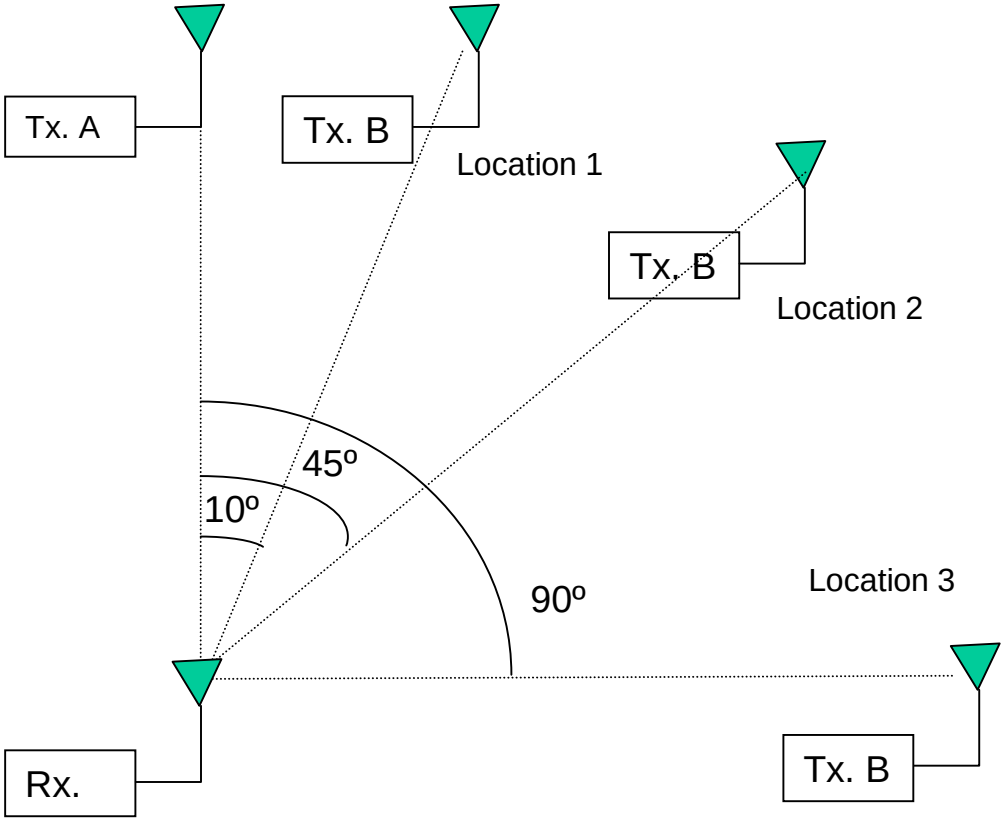
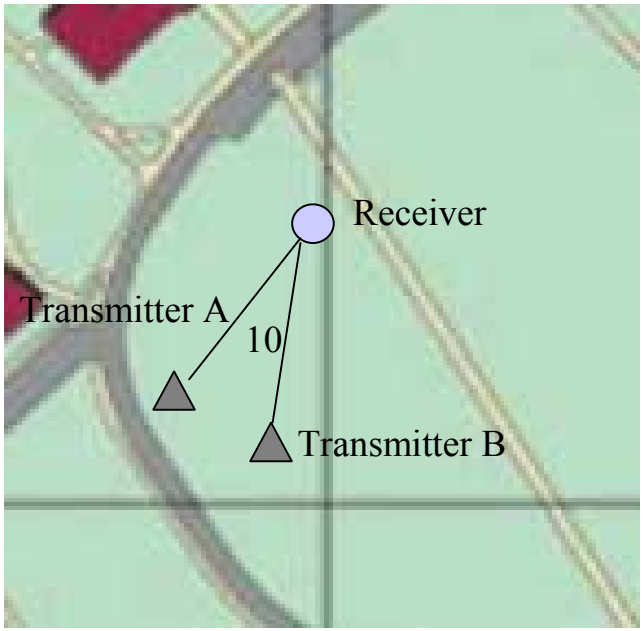
Suburban Interference Rejection Measurement Scenario





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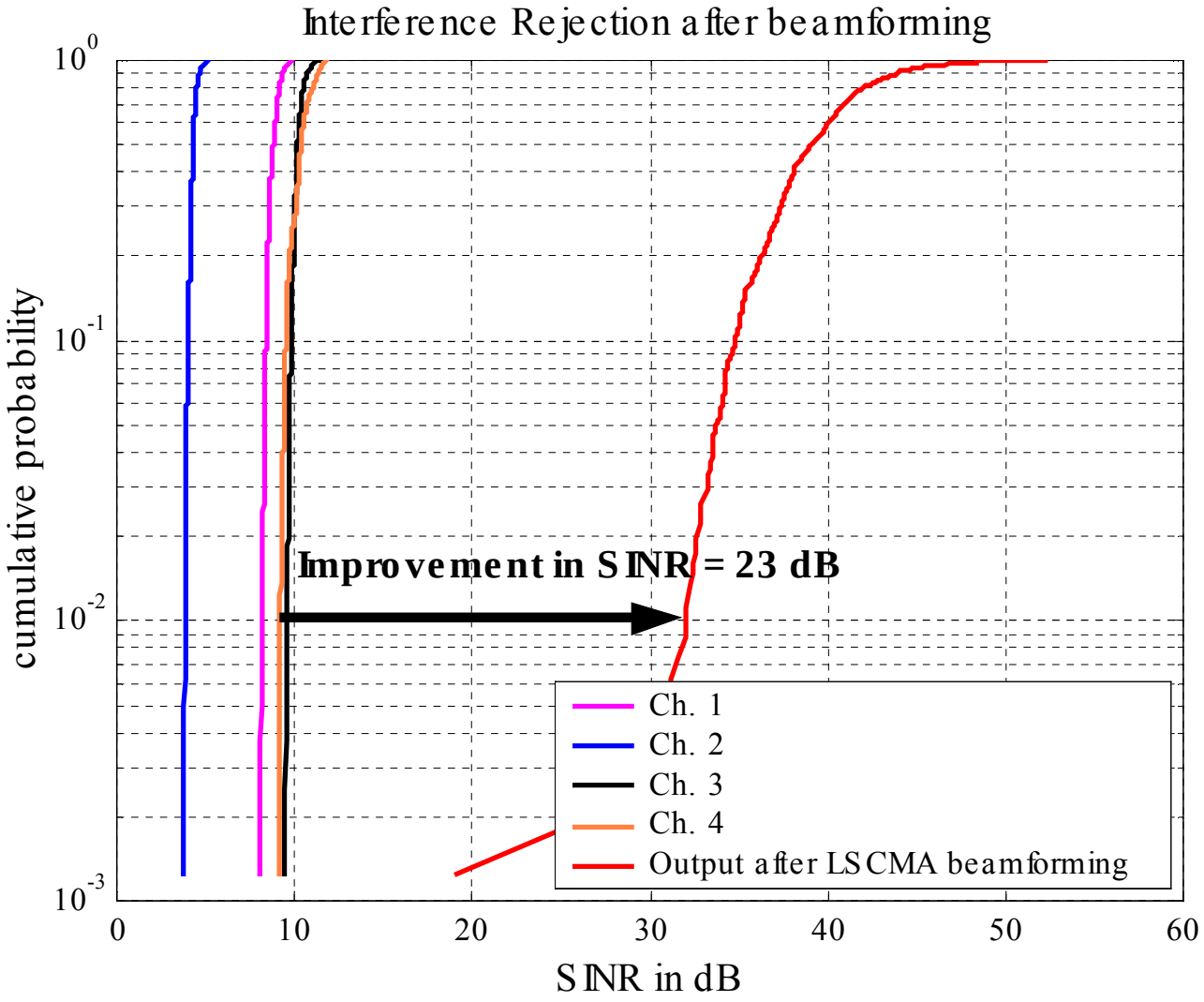
Interference Rejection



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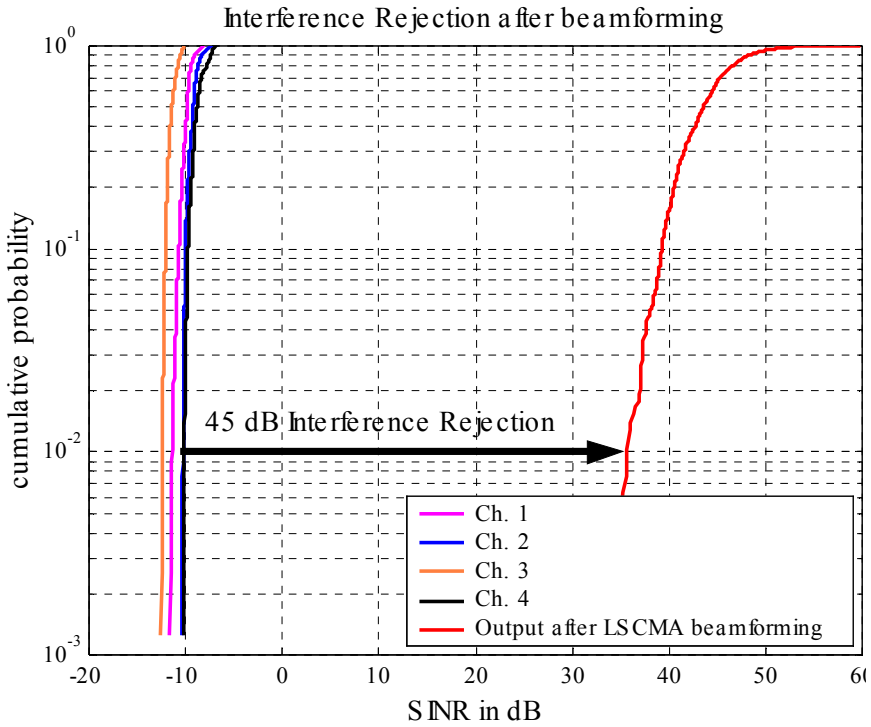
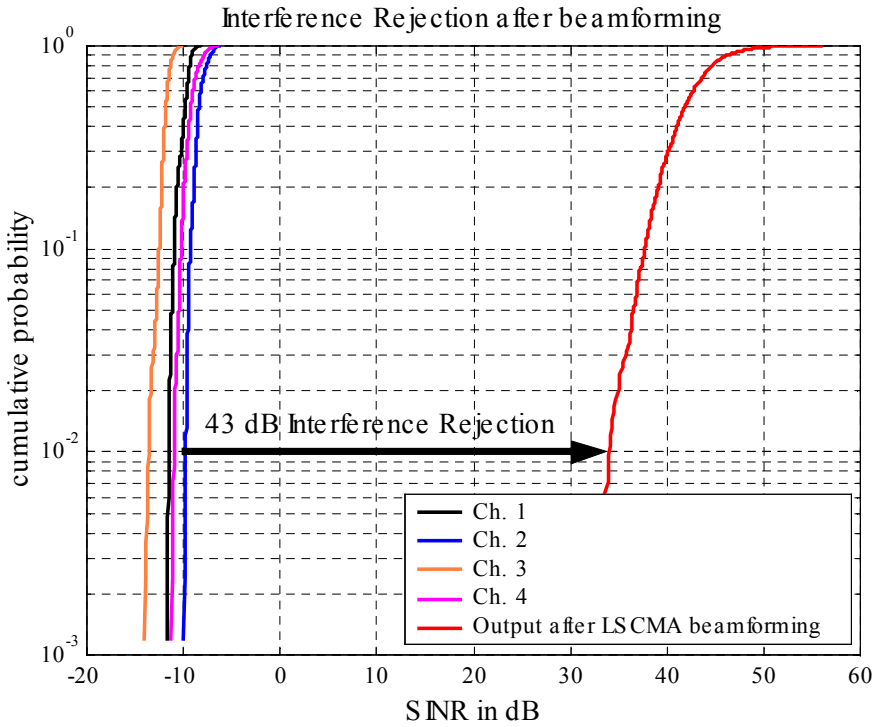
Interference Rejection in Azimuth Plane with Linear array





Interference in Broadside

ΔSINR = 45 dB

SINR at 1% CDF = 35.9 dB

Interference in Endfire

ΔSINR = 43 dB

SINR at 1% CDF = 34.0 dB

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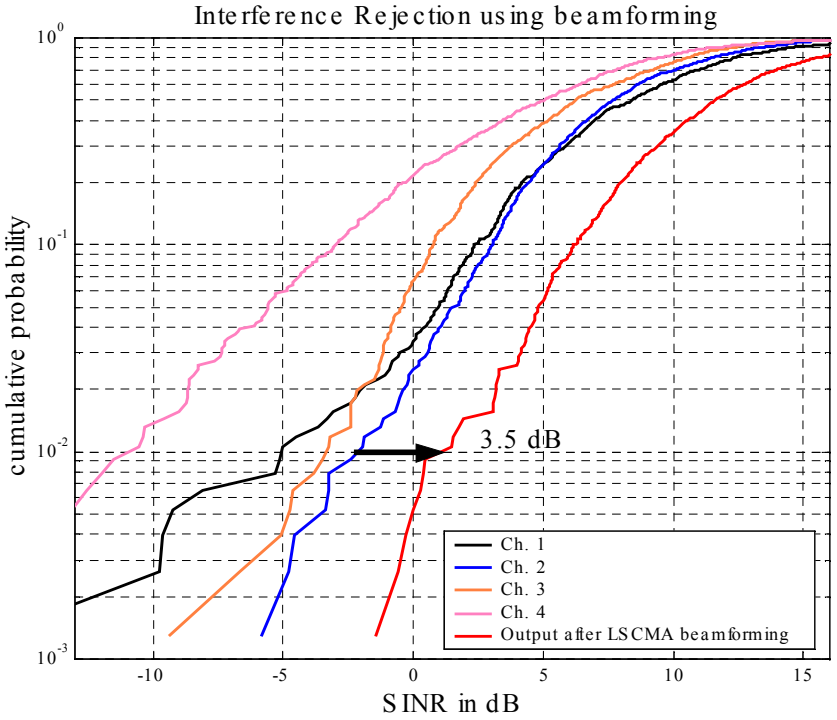
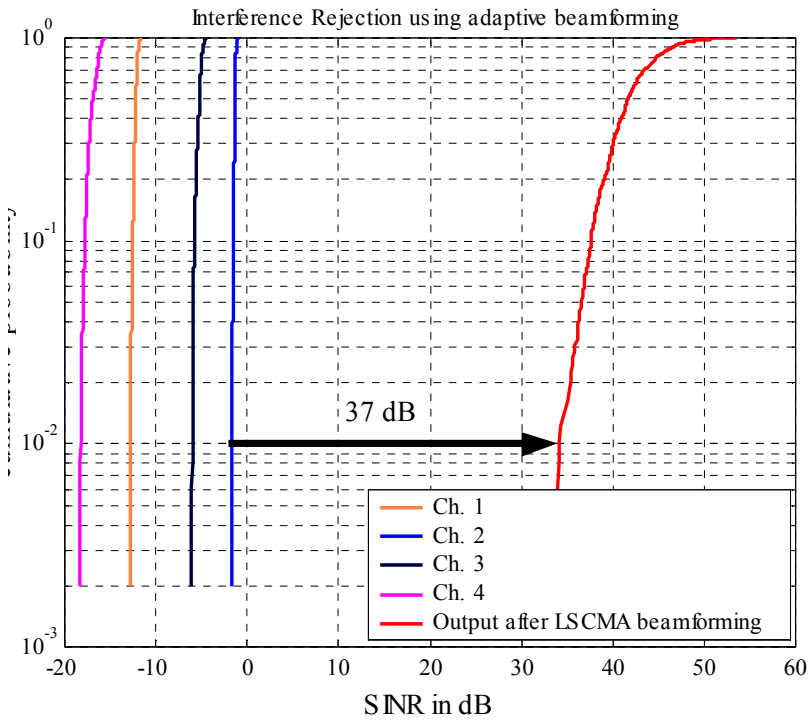
Interference Rejection in Azimuth Plane with Sectorized Square array - I





Separation in Azimuth = 10º

ΔSINR = 3.5 dB

SINR at 1% CDF = 32.4 dB

Separation in Azimuth = 45º

ΔSINR = 37.0 dB

SINR at 1% CDF = 33.0 dB

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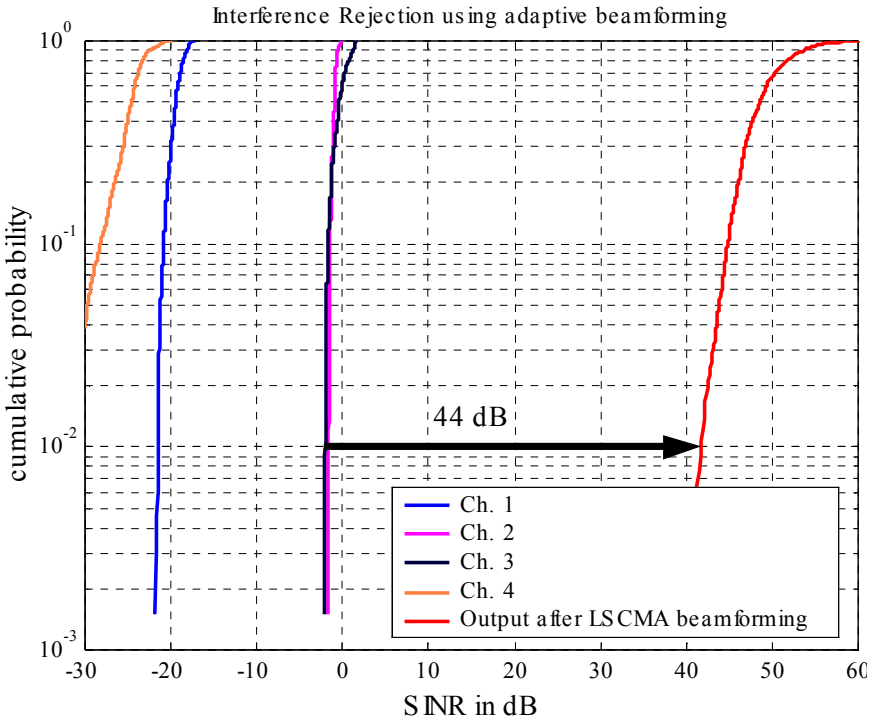
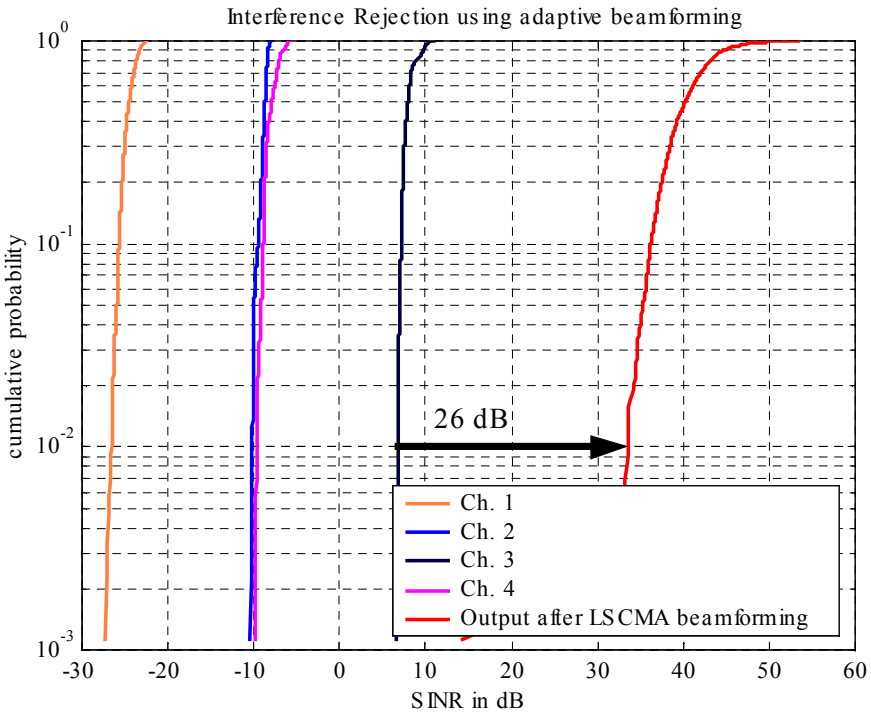
Interference Rejection in Azimuth Plane with Sectorized Square array - II





Separation in Azimuth = 90º

ΔSINR = 44.0 dB

SINR at 1% CDF = 41.8 dB

Separation in Azimuth = 180º

ΔSINR = 26.0 dB

SINR at 1% CDF = 33.4 dB

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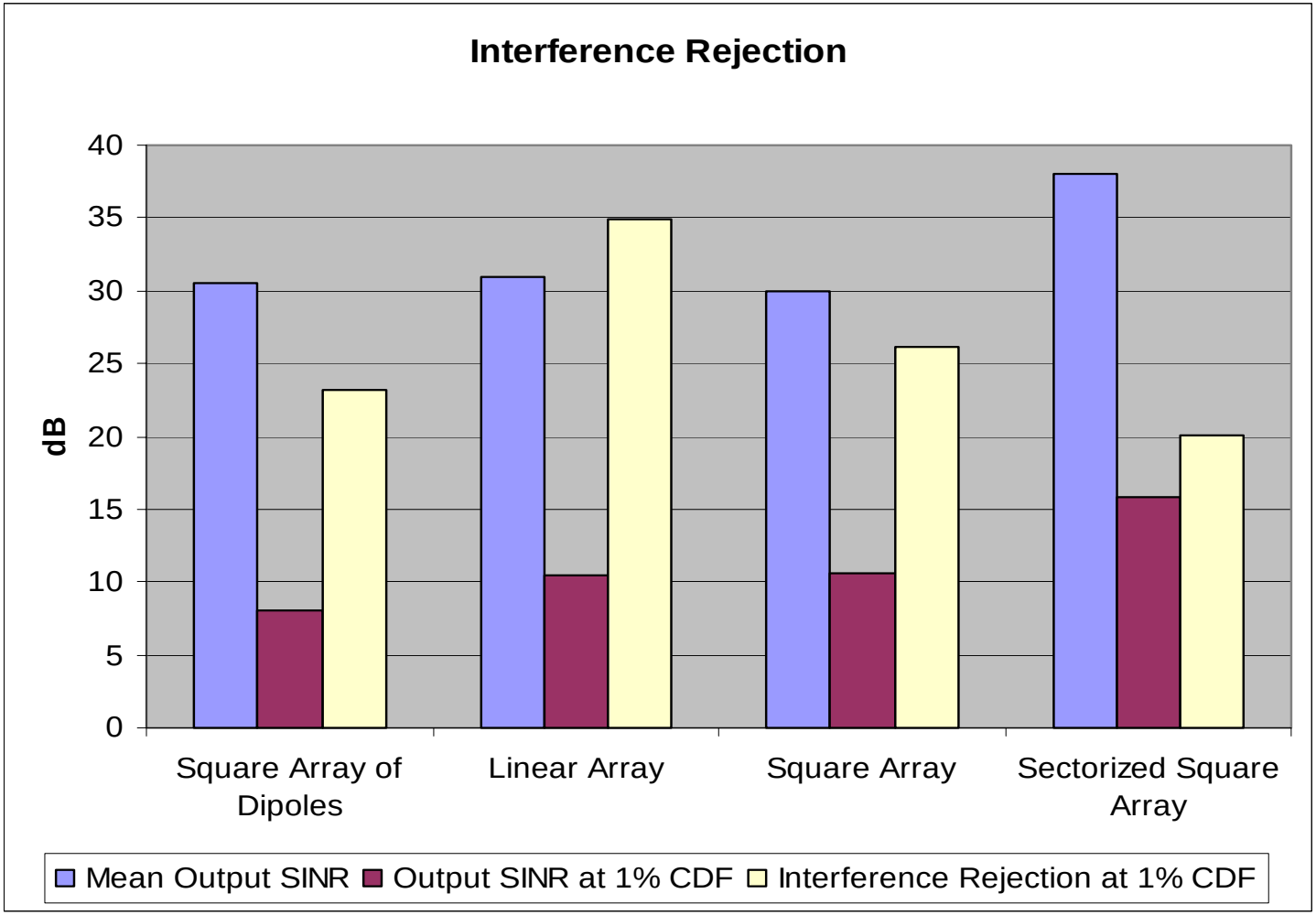
Vehicle-mount array performance comparison in Suburban LOS Scenario



Sectorized Square array and Linear array with broadside interference rejection showed marginal superior performance over the square array

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Summary and Conclusion
Diversity Combining

- In an obstructed non-line-of-sight (NLOS) urban channel with maximal ratio combining the diversity gain of the arrays ranged from 11.4 to 17.8 dB.
- Linear array offered increased diversity gain as compared to the square array in suburban line-of-sight and obstructed non – LOS scenario. High diversity gain was recorded for the sectorized square array due to its high element gain
- For arrays mounted on a vehicle roof-top in suburban measurement scenario Diversity gain values of 9.6 – 14.6 dB were recorded, again with the linear array offering superior performance

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Summary and Conclusion
Interference Rejection

- Linear array offers better interference rejection in broadside as compared to in endfire orientation.
- Under similar experimental conditions the linear array showed marginal improvement in interference rejection over the square array. Sectorized Square Array offered best interference rejection capability due to its high element gain.
- Arrays performed equally well in rejecting interference with 28 – 44.0 dB improvement in SINR when mounted on a vehicle rooftop in a suburban environment with sectorized square array offering best results

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