Cellular Range Telemetry Network: Field Test Results Overview

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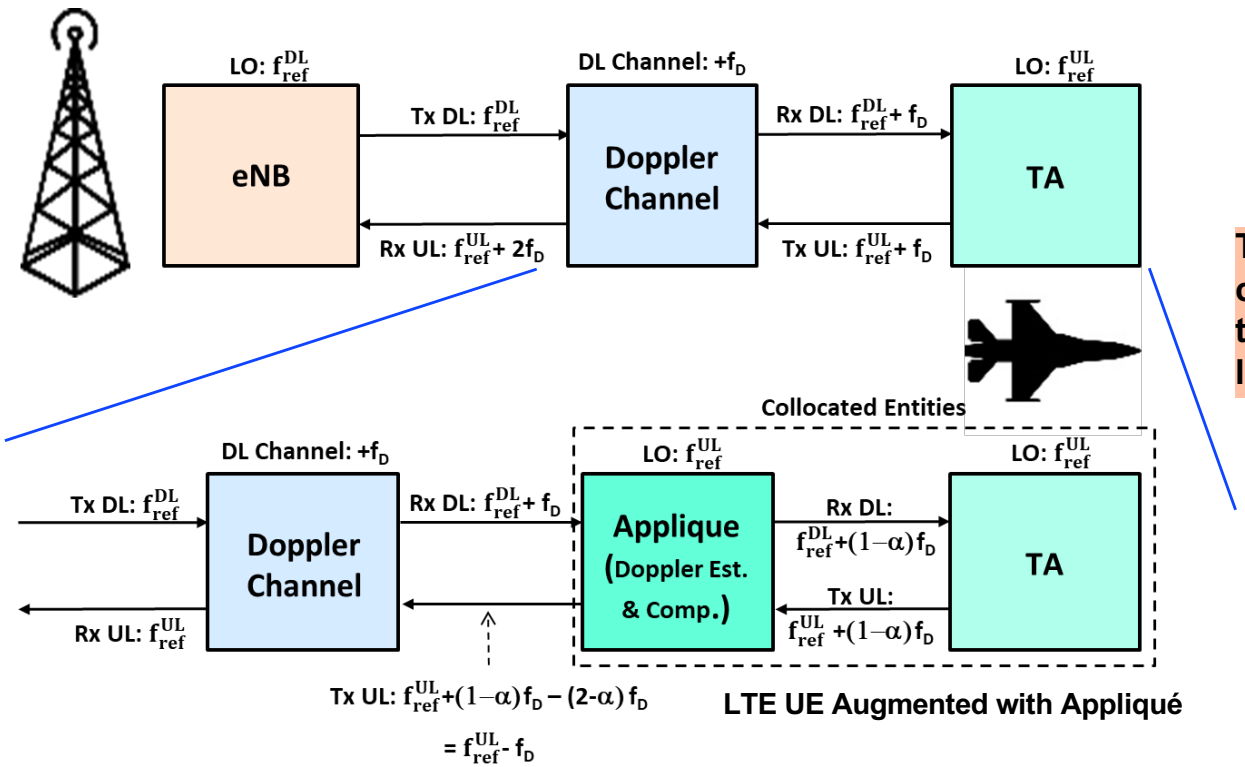
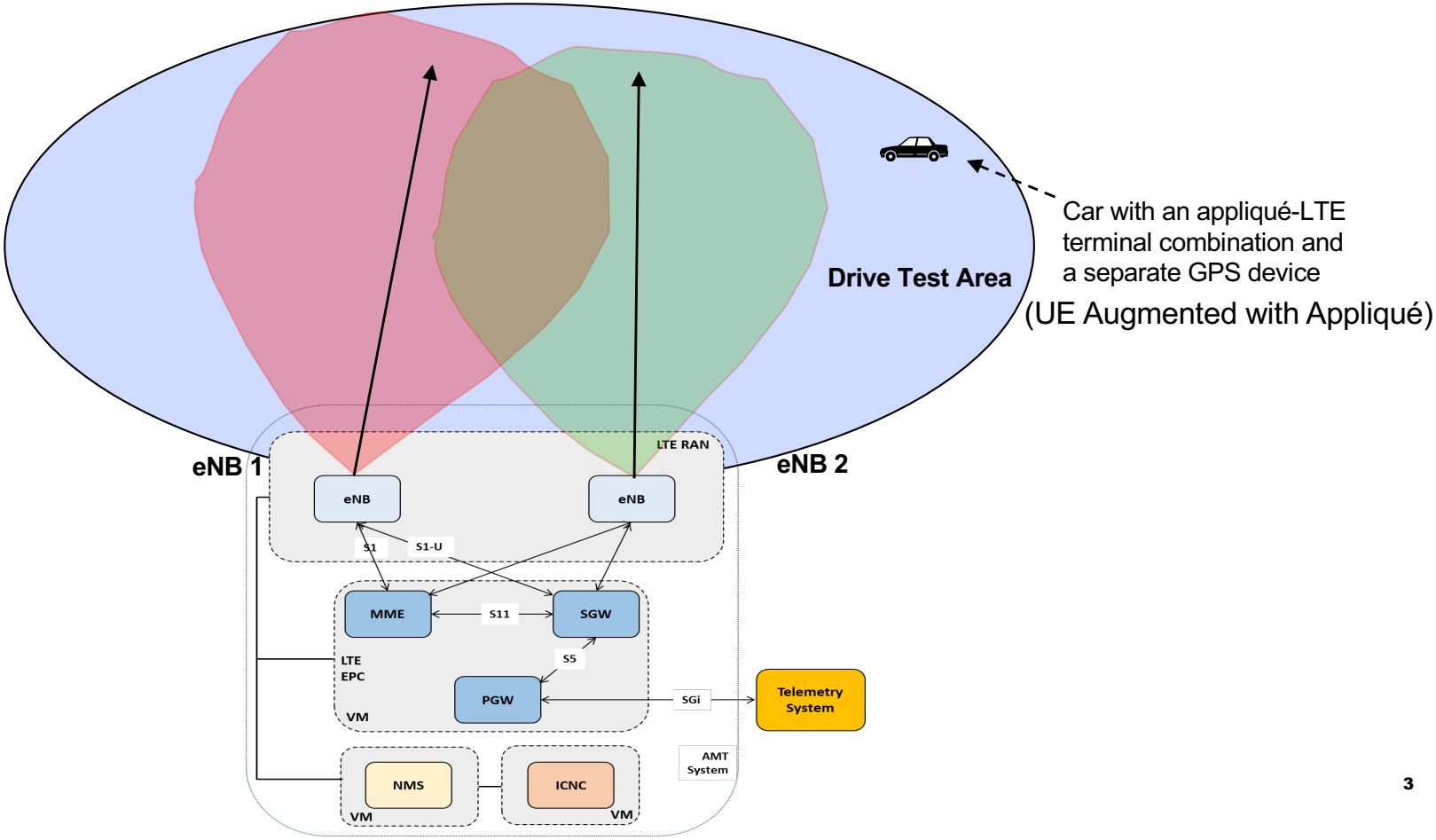
Addressing high Doppler shifts in Aeronautical Mobile Telemetry (AMT) – the Perspecta Labs solution



The LTE UE-appliqué combination has been tested extensively in the lab.

The field test setup – ground test



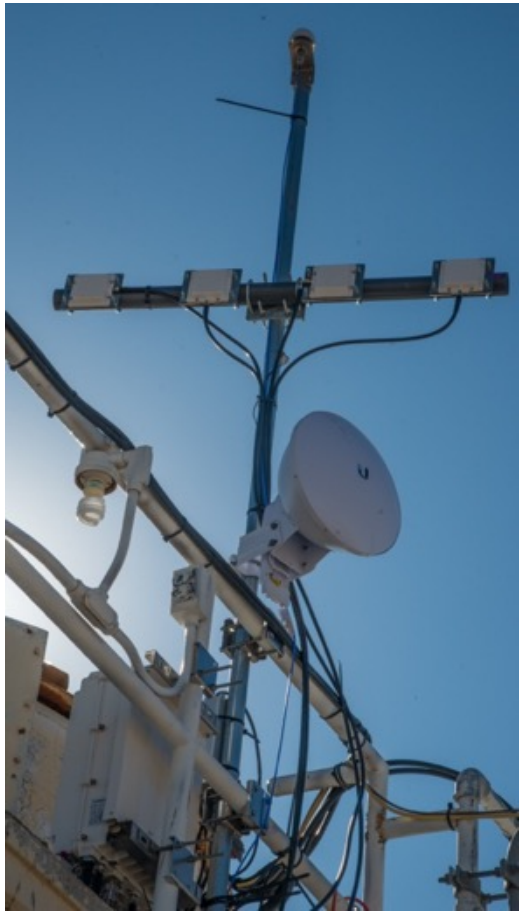
CeRTN 4G LTE base station site installation

Parameter	Value
Operating Frequency	Lower C 4.4-5.0GHz
Bandwidth	20MHz
Duplexing Mode	TDD
eNB Antennas	4Rx, 2Tx
Patch Antennas	Broad Beam-width
Test Article Antennas	2Rx, 1Tx

eNB1

eNB1

eNB2



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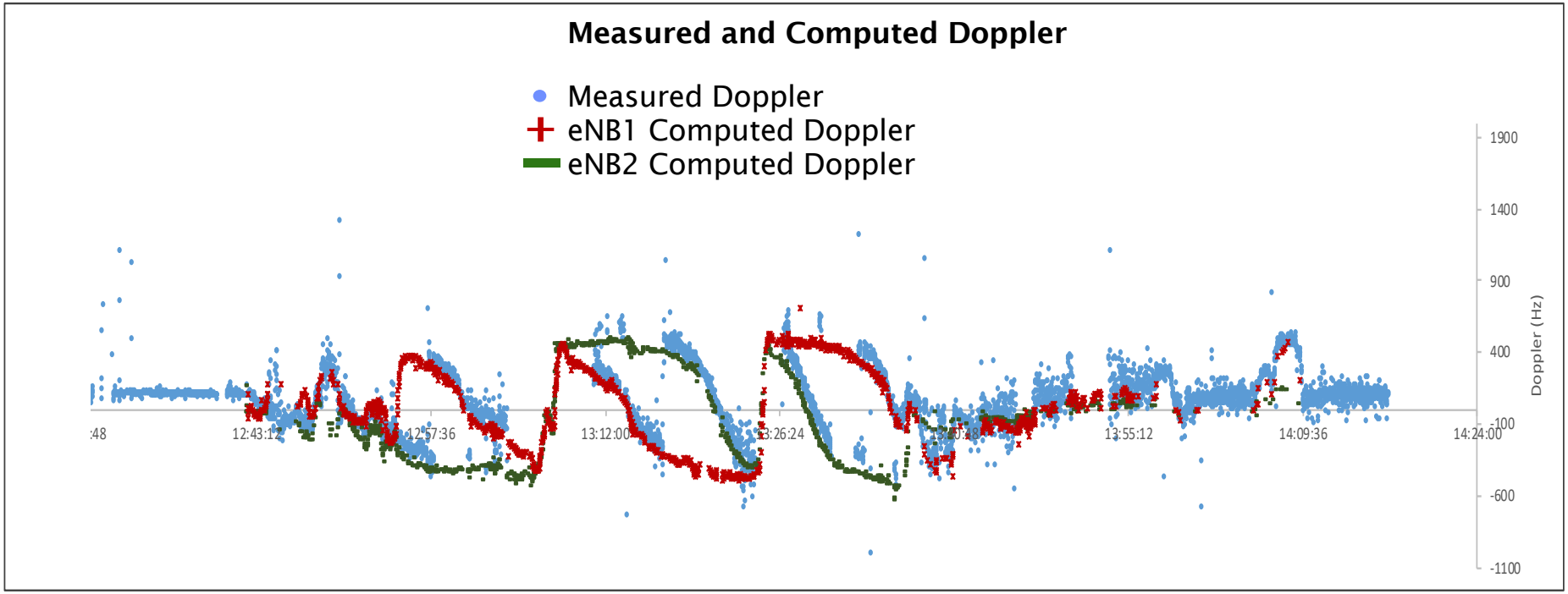
Applique Doppler shift tracking

- Tracking during Handover events
- Computed Doppler generated from GPS readings of the TA
- Measured Doppler estimated and applied at the applique



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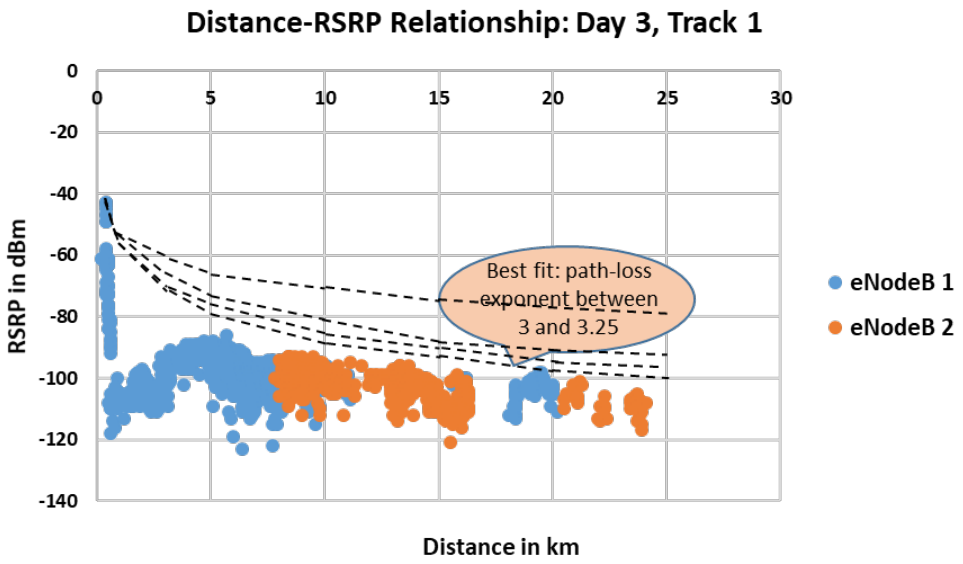
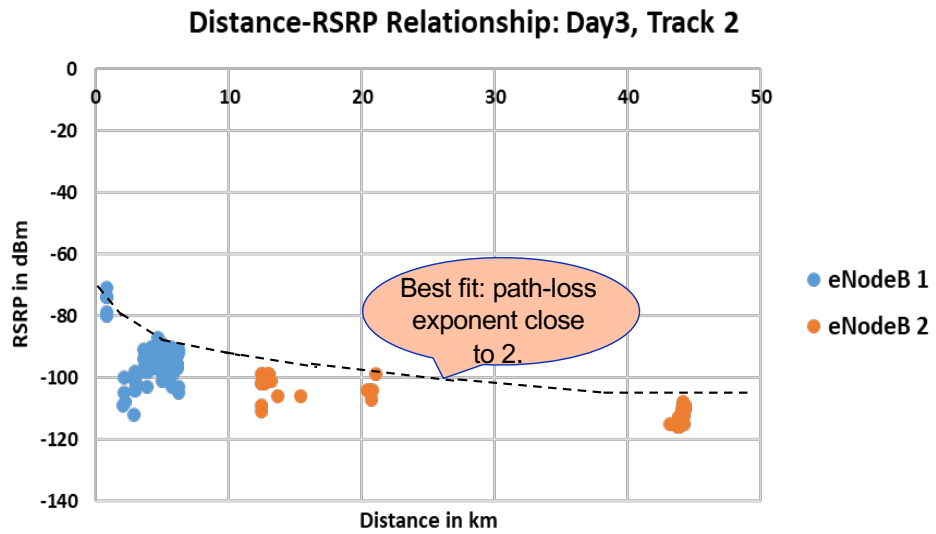
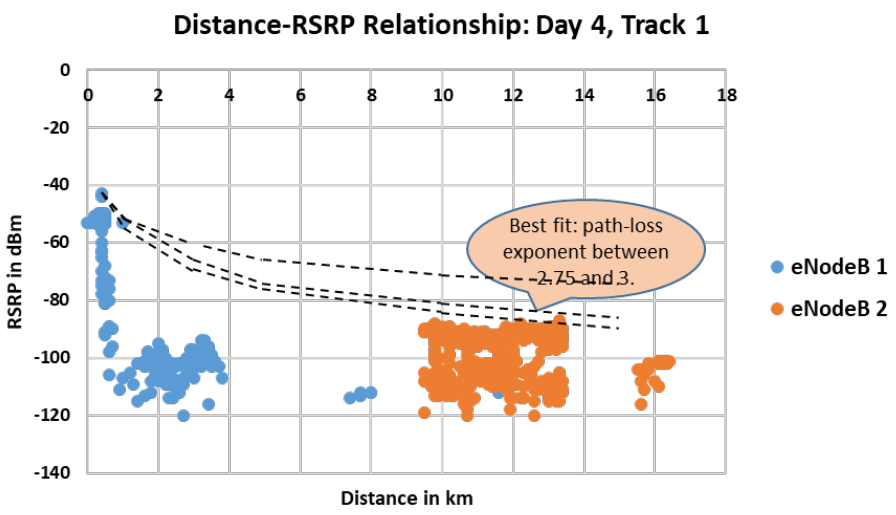
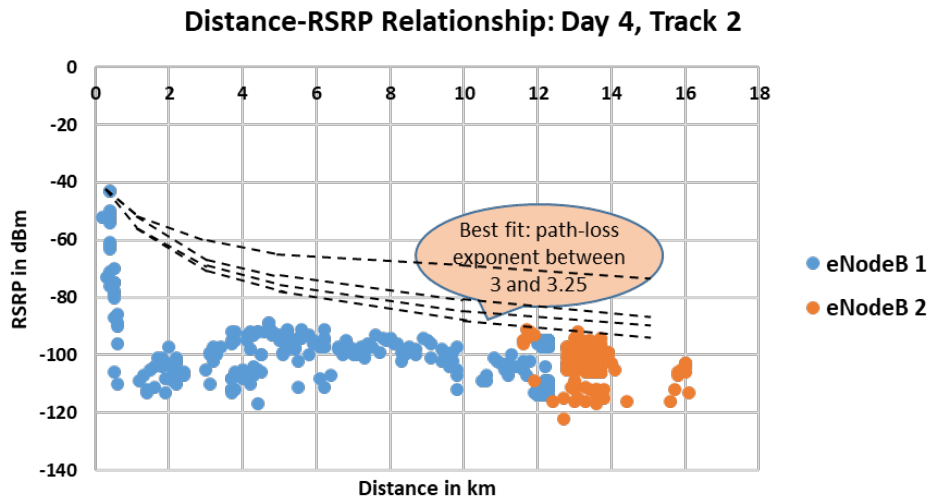
Field test results: distance-RSRP relationship 1





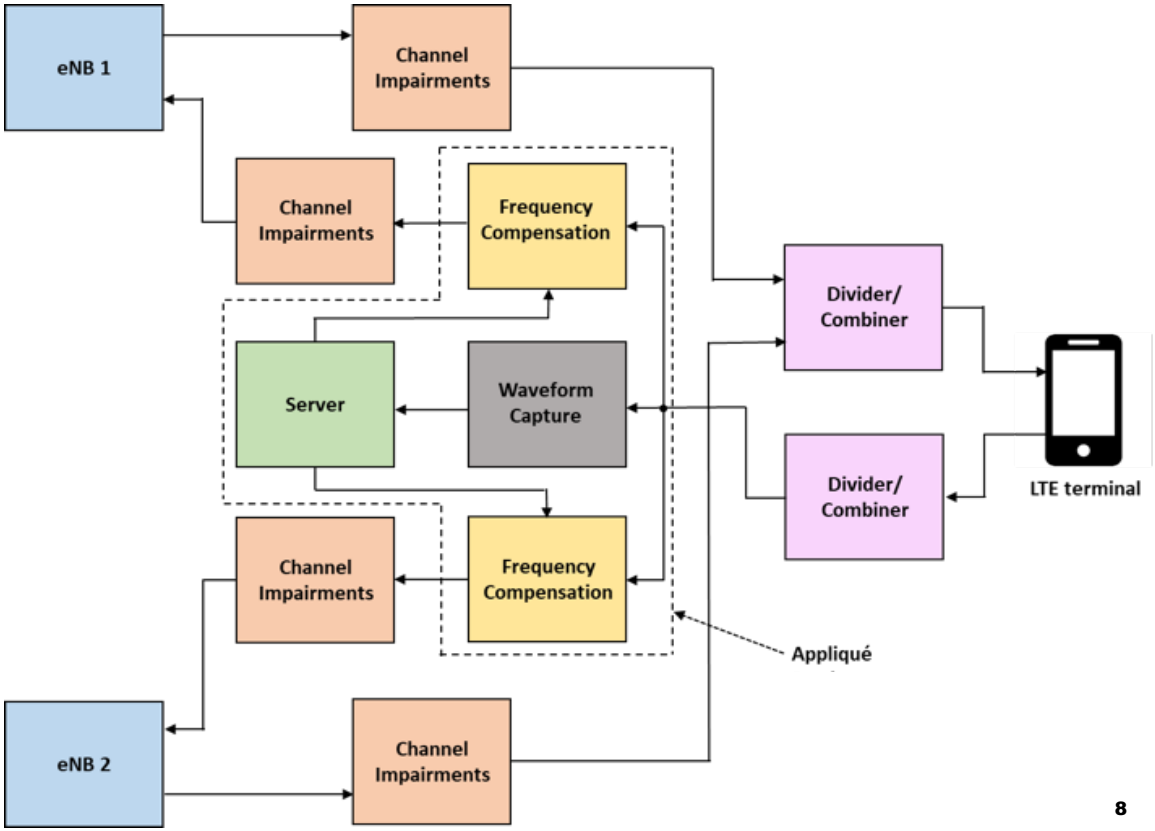
Field test results: distance-RSRP relationship 2





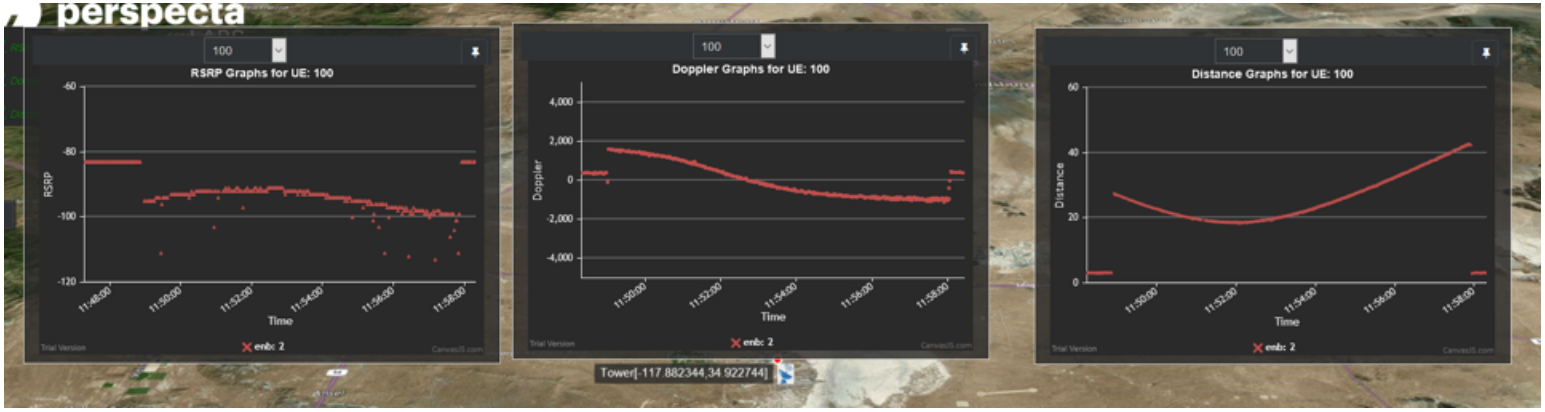
Laboratory flight path emulation

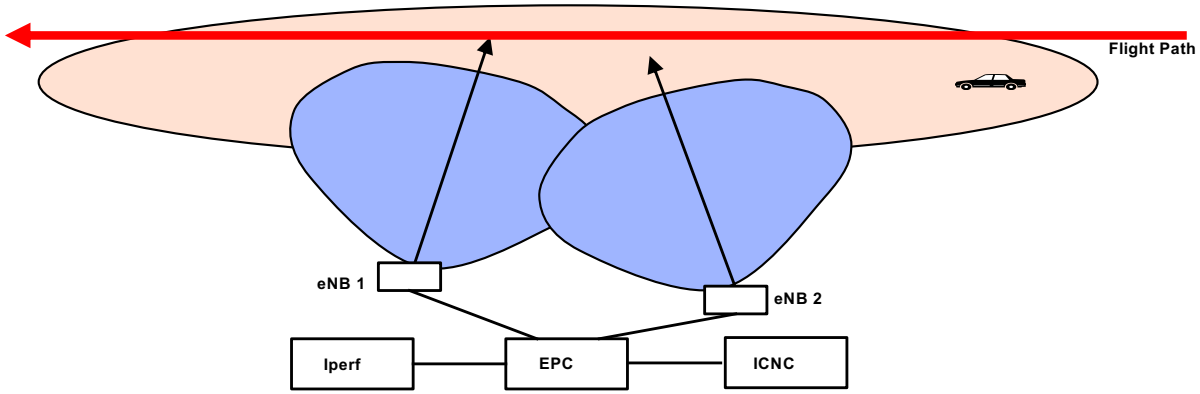
- Reproduce an accurate emulation of an actual flight plan in the lab:
- Two eNBs, one TA: Doppler, Gain, and Distance from eNB calculated from flight plan and played back in real time



Flight plan emulation in lab: ICNC output

- Straight Flight East to West





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Conclusion

- Throughout the field test (as well as the lab tests), the appliqué was able to accurately estimate and compensate for the Doppler shift associated with the serving eNB and helped maintain the LTE link.
- Propagation analysis complicated by several factors:
  - Presence of shadowing
  - lack of a large number of independent measurements.
- Some conclusions can still be drawn from the available data:
  - Fitting a power-law curve to the highest observed RSRP levels in the distance-RSRP graphs yielded values of path-loss exponent that vary between 2.00 and 3.25.
  - These measurements lead us to believe that for an airborne TA, the path-loss exponent is likely to be close to its free-space value of 2. (Higher received power levels at similar distances.)
  - Often, (per-UE) throughput levels between 25 and 30 Mbps were reached even at a distance of 16 km. Using this observation in conjunction with the previous one, one can reasonably expect an airborne TA to attain similar throughputs at significantly larger distances.

Thank you

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