



# MOTIVATION FOR NEW WID: NR POSITIONING SUPPORT

Source: Intel Corporation  
Agenda Item: 9.1.1

# OUTLINE

## Highlights of Rel-16 Study Item on NR Positioning Support

- Target requirements, evaluation scenarios, performance metrics
- NR positioning techniques
  - DL only, UL only, DL+UL positioning techniques
- Reference signals and measurements
  - DL and UL reference signals
  - UE and gNB measurements
- Architecture and Protocols Aspects

## Objectives of new WID “NR Positioning Support”

# TARGET PERFORMANCE REQUIREMENTS

## Target Regulatory Requirements

- Horizontal positioning error  $\leq 50\text{m}$  for 80% of UEs
- Vertical positioning error [ $<5\text{ m}$ ] for [80%] of UEs
  - Note: The regulatory requirements refer to floor level vertical accuracy
- End to end latency and TTFF  $< 30$  seconds

## Target Commercial Requirements

- Horizontal positioning error  $< 3\text{m}$  for 80% of UEs in indoor deployment
- Vertical positioning error  $< [3]\text{ m}$  for [80]% of UEs in indoor deployment
- Horizontal positioning error  $< 10\text{m}$  for 80% of UEs in outdoor deployment
- Vertical positioning error  $< [3]\text{m}$  for [80]% of UEs in outdoor deployment
- End to end latency  $< [1]\text{s}$

Note: Target requirements are selected by RAN WG1 for RAT dependent positioning solutions taking into account input from SA WG1 in 3GPP TR 22.872

# EVALUATION SCENARIOS & PERFORMANCE METRICS

## Baseline Evaluation Scenarios for RAT-Dependent NR Positioning Studies

- Scenario 1 - Indoor Open Office (FR1 & FR2)
- Scenario 2 - UMi street canyon (FR1 & FR2)
  - ISD 200m, only outdoor UEs
- Scenario 3 - UMa (FR1 only)
  - Macro cell only scenario, ISD 500m, indoor and outdoor UEs
- All scenarios were evaluated w/o w/ and network synchronization error

## Performance Metrics

- Positioning accuracy - CDF of horizontal/vertical positioning errors
- Other metrics
  - Latency, UE power consumption, capacity, network/UE/gNB complexity, availability

Note: RAN WG1 designed NR positioning evaluation methodology which is a part of the 3GPP TR 38.855 and was used for analysis of NR positioning solutions

# POSITIONING TECHNIQUES, SIGNALS & MEASUREMENTS – RAN1 CONCLUSIONS

## NR Positioning Techniques

- DL only positioning
  - DL-TDOA, DL-AoD
- UL only positioning
  - UL-TDOA, UL-AoA
- DL + UL positioning
  - RTT, E-CID

## UE Measurements

- DL RSRP, DL RSTD, UE RX-TX time difference

## DL Reference Signals

- DL positioning reference signals
  - are to be introduced
- R15 legacy signals
  - If/how to use is to be discussed in WI

## gNB Measurements

- UL RSRP, UL RTOA, gNB RX-TX time difference, UL AoA

## UL Reference Signals

- UL SRS is a starting point
  - Enhancements are to be discussed in WI

Note: RAN WG1 come up with DL only, UL only and DL+ UL positioning techniques. Identified reference signals and required measurements at gNB/UE sides

# PROTOCOL AND ARCHITECTURE ASPECTS – RAN2 & RAN3 CONCLUSIONS

## RAN2 Conclusions

- LPP is extended for NR positioning
- Location management in RAN
  - Option is recommended for normative work, provided the concerns raised in the study phase are addressed
- NG-RAN acting as LCS client
  - LCS client solution doesn't have RAN2 impact, there are multiple candidate solutions for location exposure to RAN (e.g. MDT, location management functionality in RAN)

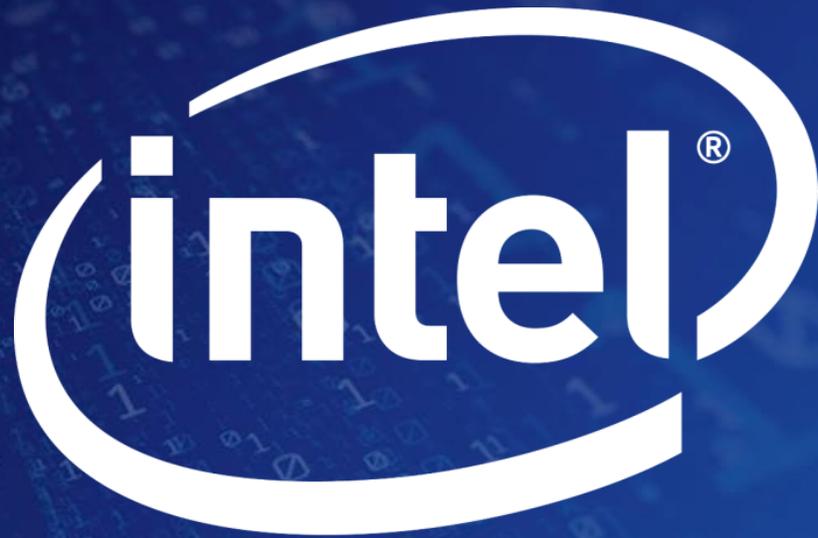
## RAN3 Conclusions

- NRPPa is extended for NR positioning
- Location management in RAN
  - Common understanding was not reached on any recommendation
- NG-RAN acting as LCS client
  - Require more justification in terms of scenarios as well as additional consideration on the authorization and privacy aspects

# WID ON NR POSITIONING SUPPORT – OBJECTIVES

## Overview of Objectives (RP-190194)

- RAN1 centric
  - DL/UL reference signal design including reuse of R15 signals
  - Resource allocation for PRSs
  - Definition of UE/gNB measurements
  - Physical layer procedures
  - Mapping of DL/UL reference signals and measurements to techniques
- RAN2 centric
  - LPP extension and PPP-RTK support for NR positioning
  - Study phase on UE based positioning
- RAN3 centric
  - NRPPa extension for NR positioning
- RAN2+RAN3 centric
  - Support of NR positioning methods
- RAN3 + RAN2 centric objectives
  - Study phase on 1) Location management functionality in RAN and 2) NG RAN acting as LCS
- RAN4 centric
  - Define core + performance requirements and test cases for NR positioning



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