### Maintenance of NR positioning support

#### DL Reference Signals for NR Positioning

[R1-2001558](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001558.zip) Maintenance of DL PRS for NR positioning Huawei, HiSilicon

[R1-2001600](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001600.zip) Maintenance of DL reference signals for NR positioning ZTE

[R1-2001685](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001685.zip) Discussion on remaining issues on DL RS for NR positioning vivo

[R1-2001731](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001731.zip) Remaining Issues on DL Positioning Reference Signal OPPO

[R1-2001954](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001954.zip) Remaining details of DL Reference signals for NR positioning LG Electronics

[R1-2002046](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002046.zip) Remaining details on DL Reference Signals Futurewei

[R1-2002095](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002095.zip) Remaining issues on DL PRS for NR Positioning CATT

[R1-2002144](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002144.zip) DL Reference Signals for NR Positioning Samsung

[R1-2002288](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002288.zip) Corrections to DL reference signals for NR positioning Intel Corporation

[R1-2002557](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002557.zip) Discussion on DL PRS processing & related UE capabilities Qualcomm Incorporated

[R1-2002620](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002620.zip) Maintenance of rel16 DL reference signals for NR positioning Ericsson

[100b-e-NR-Pos-01] Email discussion/approval on the following issues related to UE DL PRS processing capabilities by 4/24; if necessary, followed by endorsing the corresponding TPs by 4/29 – Alexey (Intel)

* How to define duration for UE DL PRS processing capabilities
* Reporting of UE DL PRS processing capabilities and T values
* Dependence on BW and SCS
* Simultaneous DL PRS processing across frequency layers
* UE DL PRS processing capabilities for cases with and without measurement gap configured

Agreement:

* For the purpose of DL PRS processing capability, the duration of DL PRS symbols (*K*) in ms within any *P* msec window, is calculated by
  + Type 1 duration calculation with



* + Type 2 duration calculation with



* + where
    - Type 1 or Type 2 is reported as UE capability,
    - is *the* set of slots of a serving cell within the *P* msec window in the positioning frequency layer that contains potential DL PRS resources considering the actual nr-DL-PRS-ExpectedRSTD, nr-DL-PRS-ExpectedRSTD-Uncertainty provided for each pair of DL PRS Resource Sets (target and reference),



* + - for Type 1, is the smallest interval in ms within slot corresponding to an integer number of OFDM symbols of a serving cell that covers the union of the potential PRS symbols and determines the PRS symbol occupancy within slot .



* + - * Interval considers the actual nr-DL-PRS-ExpectedRSTD, nr-DL-PRS-ExpectedRSTD-Uncertainty provided for each pair of DL PRS Resource Sets (target and reference).



Agreement:

* For UE DL PRS processing capability,
  + UE reports one combination of (N, T) values per band, where N is a duration of DL PRS symbols in ms processed every T ms for a given maximum bandwidth (B) in MHz supported by UE
  + Additionally, UE reports new parameter, number of DL PRS resources that UE can process in a slot, which is reported per SCS per band.
    - Values: {1, 2, 4, 8, 12, 16, 32, 64}
* The following sets of values for N, T and B are supported
  + Values for N = {0.125, 0.25, 0.5, 1, 2, 4, 8, 12, 16, 20, 25, 30, 35, 40, 45, 50} ms
  + Values for T = {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms
  + Values for maximum BW reported by UE = {5, 10, 20, 40, 50, 80, 100, 200, 400} MHz

Agreement:

The reporting of (N, T) values for maximum BW in MHz is not dependent on SCS

Agreement:

UE capability for simultaneous DL PRS processing across positioning frequency layers is not supported in Rel.16 (i.e. for a UE supporting multiple positioning frequency layers, a UE is expected to process one frequency layer at a time)

Agreement:

UE capability for DL PRS processing is defined assuming the case with configured measurement gap and a maximum ratio of measurement gap length (MGL) / measurement gap repetition period (MGRP) of no more than X%

* FFS: X

[100b-e-NR-Pos-02] Email discussion/approval on the following issues by 4/23; if necessary, followed by endorsing the corresponding TPs by 4/28 – Alexey (Intel)

* Corrections to 38.211
  + PRS/SSB collision handling for neighbour cells
  + Missing value in muting pattern
  + Periodicity in slots for DL PRS transmission
  + Relationship b/w number of symbols and comb factor
* NR-TimingMeasQuality for RSTD

Agreement:

The following text proposal for TS 38.211 is agreed.

--------------- Begin TP -------------------

**7.4.1.7.3 Mapping to physical resources in a downlink PRS resource**

- the symbol is not used by any SS/PBCH block used by the serving cell for downlink PRS transmitted from the serving cell or any SS/PBCH block from a non-serving cell indicated by the higher-layer parameter *SSB-positionInBurst* for downlink PRS transmitted from ~~a~~ the same non-serving cell;



----------------- End TP ---------------------------

Agreement:

The following text proposal for TS 38.211 is agreed.

------------------ Begin TP ----------------------

**7.4.1.7.4 Mapping to slot in a downlink PRS resource set**

<Text is omitted>

For a downlink PRS resource in a downlink PRS resource set, the UE shall assume the downlink PRS resource being transmitted when the slot and frame numbers fulfil



<Text is omitted>

- is bit in the bitmap given by the higher-layer parameter *DL-PRS-MutingPattern* where is the size of the bitmap;



- is bit in the bitmap given by the higher-layer parameter *DL-PRS-MutingPattern;*



<Text is omitted>

the periodicity is given by the higher-layer parameter  *dl-PRS-Periodicity-and-ResourceSetSlotOffset-r16*;



<Text is omitted>

---------------------- End TP -------------------------

Agreement:

The following text proposal for TS 38.211 is agreed.

--------------------------- Begin TP ----------------------------

**7.4.1.7.3 Mapping to physical resources in a downlink PRS resource**

<Text is omitted>

and where

- is the first symbol of the downlink PRS within a slot and given by the higher-layer parameter *DL-PRS-ResourceSymbolOffset*;



- the size of the downlink PRS resource in the time domain is given by the higher-layer parameter *DL-PRS-NumSymbols*;



- the comb size is given by the higher-layer parameter *transmissionComb~~;~~*, such that combination of {, } is one of {2, 2},{4, 2}, {6, 2}, {12, 2}, {4, 4}, {12, 4}, {6, 6}, {12, 6} and {12, 12};



- the resource-element offset is given by the higher-layer parameter *combOffset*;



- the quantity is given by Table 7.4.1.7.3-1.



<Text is omitted>

---------------------------- End TP ----------------------------------

Conclusion:

* It is RAN1 understanding that the NR-TimingMeasQuality is the quality for time of arrival measurements
* NR-TimingMeasQuality is left up to UE implementation
* Notes:
  + No RAN1 specification changes are required.
  + NR-TimingMeasQuality measurement is also applicable for the reference timing used in RSTD measurements

#### UL Reference Signals for NR Positioning

[R1-2001559](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001559.zip) Maintenance of SRS for NR positioning Huawei, HiSilicon

[R1-2001601](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001601.zip) Maintenance of UL reference signals for NR positioning ZTE

[R1-2001686](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001686.zip) Discussion on remaining issues on UL RS for NR positioning vivo

[R1-2001732](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001732.zip) Remaining Issues on UL Positioning Reference Signal OPPO

[R1-2002038](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002038.zip) Maintenance on UL reference signals for NR Positioning Nokia, Nokia Shanghai Bell

[R1-2002047](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002047.zip) Remaining details on UL Reference Signals Futurewei

[R1-2002096](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002096.zip) Remaining issues on UL SRS for NR Positioning CATT

[R1-2002145](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002145.zip) UL Reference Signals for NR Positioning Samsung

[R1-2002199](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002199.zip) Discussion on staggered SRS for NR Positioning Fraunhofer IIS, Fraunhofer HHI

[R1-2002286](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002286.zip) Corrections to UL reference signals for NR positioning Intel Corporation

[R1-2002621](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002621.zip) Maintenance of rel16 UL reference signals for NR positioning Ericsson

[100b-e-NR-Pos-03] Email discussion/approval on the following issues by 4/23; if necessary, followed by endorsing the corresponding TPs by 4/28 – Florent (Ericsson)

* UL SRS for positioning
  + Simultaneous SRS transmission in a single symbol
  + Intra-band collision between PosSRS and MimoSRS
  + PHR for SRS positioning configuration
* UL RTOA reference time

Agreement:

Adopt the following text proposal for Clause 6.2.1.4 of TS 38.214:

===================== Unchanged parts omitted ======================

For single carrier operations, the UE does not expect to be configured on overlapping symbols with more than one SRS resources configured by the higher layer parameter *SRS-PosResource* with *resourceType* of the SRS resources as ‘periodic’.

For single carrier operations, the UE does not expect to be triggered to transmit SRS on overlapping symbols with more than one SRS resources configured by the higher layer parameter *SRS-Pos-Resource* with *resourceType* of the SRS resources as ‘semi-persistent’ or ‘aperiodic’.

===================== Unchanged parts omitted ======================

Agreement:

Introduce a new UE capability for the number of SRS resources for positioning on a symbol for intra-band CA

* FFS: Capability for simultaneous SRS transmission across bands for inter-band CA
* Continue discussion on capability for intra-band/inter-band CA, including potential TP to 38.214 to reflect the new capability.

Agreement:

Change all occurrences of “[SRS-for-positioning]” to the higher layer parameter agreed by RAN2 WG called “SRS-PosResource-r16” in TS 38.211 Section 6.4.1.4

Discuss a potential merge from TP1 (proposal 4 in R1-2001559) until the TP deadline (29/4)

Conclusion:

For release 16, type3 PHR based on SRS for positioning is not supported.

TP to reflect the conclusion in 38.213. Use the option 1 TP from R1-2001686 as a starting point.

* Note: Option 1 is UE report type 3 PHR only based on SRS configured by SRS-Resource / ResourceSet.

Agreement:

* Introduce a new parameter to the higher layer parameter list according to the table below.
* The RTOA reference time is defined as T0+tSRS, where
  + T0 is the nominal beginning time of SFN 0 provided by LMF.
  + , where and are the system frame number and the subframe number of the SRS, respectively



* Send an LS to RAN3 reflecting the consensus.

Table 1 additional parameter to the higher layer parameter list

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR\_pos-Core | NR UL Measurement Report Configuration |  |  | FFS in RAN3 WG | SFN Initialization time | SFN initialization time | New |  | The nominal beginning time of SFN 0 for SRS | Same as SFN initialization time in LPPa  BIT STRING (64) |  |  | NRPPa 38.455 |  | Time in seconds relative to 00:00:00 on 1 January 1900 (calculated as continuous time without leap seconds and traceable to a common time reference) where binary encoding of the integer part is in the first 32 bits and binary encoding of the fraction part in the last 32 bits. The fraction part is expressed with a granularity of 1 /2\*\*32 second. |

Continue discussing the scope of the TP (e.g. remove bracket only or include the reference time details proposed in the TP) until 4/29.

#### UE and gNB measurements for NR Positioning

[R1-2001560](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001560.zip) Maintenance of NR positioning measurements Huawei, HiSilicon

[R1-2001602](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001602.zip) Maintenance of UE and gNB measurements for NR positioning ZTE

[R1-2001733](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001733.zip) Remaining Issues on Measurements for NR Positioning OPPO

[R1-2002048](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002048.zip) Remaining details on Measurements Futurewei

[R1-2002097](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002097.zip) Remaining issues on NR Positioning Measurements CATT

[R1-2002146](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002146.zip) UE and gNB measurements for NR Positioning Samsung

[R1-2002622](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002622.zip) Maintenance of rel16 UE and gNB measurements for NR Positioning Ericsson

#### Physical-layer procedures to support UE/gNB measurements

[R1-2001561](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001561.zip) Maintenance of physical layer procedures to support positioning measurements Huawei, HiSilicon

[R1-2001603](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001603.zip) Maintenance of physical-layer procedure for NR positioning ZTE

[R1-2001687](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001687.zip) Discussion on remaining issues on physical-layer procedures for NR positioning vivo

[R1-2001734](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001734.zip) Remaining Issues on Physical Layer Procedures for NR Positioning OPPO

[R1-2001955](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001955.zip) Remaining details of physical-layer procedure to support UE/gNB measurements LG Electronics

[R1-2002049](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002049.zip) Remaining details on Measurement Procedures Futurewei

[R1-2002098](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002098.zip) Remaining issues on NR Positioning Procedures CATT

[R1-2002147](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002147.zip) Physical-layer procedures to support UE/gNB measurements Samsung

[R1-2002217](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002217.zip) Remaining issues on physical layer procedure for UL SRS transmission CMCC

[R1-2002287](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002287.zip) Corrections to physical layer procedures for NR positioning Intel Corporation

[R1-2002623](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002623.zip) Maintenance of rel16 Physical-layer procedures to support UE - gNB measurements Ericsson

[100b-e-NR-Pos-04] Email discussion/approval on the following issues by 4/24; if necessary, followed by endorsing the corresponding TPs by 4/29 – Sven (Qualcomm)

* Physical layer procedures
  + UE RX beam indication for DL-AoD positioning
  + RSTD/timing reference info clarifications
  + UE Rx-Tx Time Difference measurements configuration
  + Pathloss reference configuration
* Inter-frequency UE Rx – Tx time difference measurements

#### Others

[R1-2001735](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2001735.zip) Discussion on RE mapping in reference signal for NR positioning OPPO

[R1-2002676](file:///C:\Users\eushako\Documents\3GPP\RAN1_100b-e\Inbox\Havish_sessions\Docs\R1-2002676.zip) On positioning latency and aperiodic SRS Huawei, HiSilicon