**3GPP TSG-RAN2 Meeting #129-RAN2#129 R2-25xxxxx**

**Athens, Greece, 17th Feb 2025 - 21st Feb 2025**

**Agenda item:** 8.15

**Source:** Reliance Jio

**Title:** Summary of NavIC L1 stage 3 CR check (Reliance Jio)

**Document for:**  Discussion, Agreement

Introduction

This document is the report of the following email discussion:

* **[Post128][403][POS] NavIC L1 stage 3 CR check (Reliance Jio)**

Scope: Check the CR in R2-2409726 and update if necessary.

Intended outcome: Agreeable CR

Deadline: Phase 2: January 31st, 2025

1. Contact Information

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1. Discussion
   1. Comments on GNSS Assistance Data Elements
      1. Phase 1 Discussion: CLOSED

Companies are invited to provide their inputs wrt the changes proposed in R2-2409726 under 6.5.2.2 GNSS Assistance data Elements

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| **Company** | **Agree/Disagree** | **Remark** |
| Qualcomm |  | *GNSS-IonosphericModel:*  The last sentence of the introduction text should add the new neQuickModel2 model. E.g.,  "~~Three~~Four Ionospheric Models are supported: The Klobuchar model as defined in [4], the NeQuick model as defined in [8] , ~~and~~ the klobucharModel2 as defined in [39], and the neQuickModel2 defined in [xx]. |
| Qualcomm |  | *KlobucharModelParamater* field descriptions 🡪 *dataID*:  The last sentence seems incorrect and has changes without change bars (probably some leftover). |
| Qualcomm |  | NeQuickModel2ParameterElement-r19:  What is the reason for the modipmax-r19, modipmin-r19, mLonmax-r19, and mLonmin-r19 being OPTIONAL present? The *NeQuickModel2Parameter-r19* always provides the NeQuick parameter for 3 regions (SEQUENCE (SIZE (3))) defined by the above parameter. If the parameter defining the region are absent in each element, for which region are the parameter valid?  Since the *GNSS-IonosphericModel* is common assistance data, it should be clarified (e.g., as IE introduction text) that the parameter are applied according to [xx] and provide the ionospheric delay on the L5 frequency (see Annex I of the ICD). This is essential to understand the corresponding *GNSS-IonosphericModelReq* at LMF correctly.  In the field description table, some sentences have no period at the end. |
| Qualcomm |  | *NavIC-ClockModel2* field descriptions:  "…as described in clause 6 of [xx]."  should probably be  "…as described in clause 6.1.2 of [xx]."  In the field description table, some sentences have no period at the end.  The first parameter refers to "Table 13" in clause 6, others don't. Should be consistent. |
| Qualcomm |  | *NavModel-NavIC-KeplerianSet2* field descriptions:  "…as described under clause 6 in [xx]"  should probably be  "…as described in clause 6.1.2 of [xx]."  In the field description table, some sentences have no period at the end. |
| Qualcomm |  | *AlmanacNavIC-AlmanacSet2* field descriptions:  "…as described in clause 6 of [xx]"  should probably be  "as described in clause 6.1.3.2 of [xx]"  In the field description table, some sentences have no period at the end. |
| Qualcomm |  | *UTC-ModelSet2* field descriptions:  The new sentence: "Either utcWNlsf or utcWNlsf-ext is required for NavIC GNSS." seems not needed. *utcWNlsf* is mandatory present, and if the field *utcWNlsf-ext* is present, the field *utcWNlsf* shall be ignored by the receiver. The new sentence adds no additional value/is confusing. |
| Qualcomm |  | *NavIC-GridModelParameter* 🡪 *navic-RefITOW*, *navic-RefTOI*  Why are these two new fields needed? They provide the same information as existing *navic-RefTOWC*.  The *NavIC-GridModelParameter* always provide the ionospheric delay for L5 frequency per section 6.2.2.3:  "Message type 5 contains the ionosphere grid corrections for grid points over Indian region. The ionospheric delay corrections are broadcasted as vertical delay estimates at specified Ionospheric Grid Points (IGPs), applicable to a signal on L5 for the single frequency users over  the Indian land mass."  Therefore, "This field is applicable for NavIC L1 receiver." is confusing/missleading and the existing time stamp TOWC seems enough.  The *navic-RefITOW*, *navic-RefTOI* are equivalent to the existing *navic-RefTOWC*, so it would be rather confusing/unclear if both are present.  If the receiver is operating on L1, the calculated ionospheric correction must be multiplied by the frequency ratio (see Annex D of ICD), but this does not affect the assistance data.  The same is also the case for the Klobuchar/NeQuick parameter. Even for L1 navigation message, the parameter are for the iono delay on L5 frequency and the receiver perfoms the frequency scaling, per Annex H and I of the ICD. (Ionospheric delay is frequency dependent, and therefore, the model parameter need to be clear for which frequency they apply. Except for NavIC, it's always L1. For NavIC it seems they are always for L5. Therefore, no changes should be needed here.) |
| Nokia |  | *KlobucharModelParamater* field descriptions 🡪 *dataID*:  Remove “or” from “[38] or [xx]”. |
| Nokia |  | Field description for alfa2Ext-r19, alfa3Ext-r19, beta2Ext-r19, beta3Ext-r19  For these fields, the UE behaviour is specified if the UE is NavIC capable. What about for other GNSS? Should say something about the applicability or not of these extension fields for other GNSS? |
| Reliance Jio |  | *WRT NavIC-GridModelParameter* 🡪 *navic-RefITOW*, *navic-RefTOI*  The NavIC L5 & NavIC L1 messages use different timing representation. TOWC parameter is not available in NavIC L1 message.  The NavIC L1 message uses navic-RefITOW, navic-RefTOI parameters to convey the respective timestamp. Hence, its essential to provision these two parameters in case the GridModelParamaters are received as part of NavIC L1 message to provide relevant timestamp. |
| Reliance Jio |  | WRT *GNSS-IonosphericModel:*  Reference to L1 ICD [xx] shall be added to IE introduction text in Phase 2 Draft CR.  In our understanding a reference to NavIC L1 ICD specifies that Ionospheric model parameters received in NavIC L1 messages correspond to L5 frequency. Hence, it may not be explicitly stated in the stage 3 specification.  - This approach is consistent with Ionospheric model IE descriptions applicable to other GNSS where parameters are applicable for L1 frequency.  - This approach would also allow the use of same Ionospheric model IE by non-NavIC systems in future.  However, in case IMs are of a strong opinion that such detail is essential to be captured in stage 3 specification, we are open to explicitly specify that these “parameters provide the ionospheric delay on the L5 frequency” |
| Reliance Jio |  | We agree with the inputs towards *GNSS-IonosphericModel:*fielddescription*, KlobucharModelParamater* field descriptions 🡪 *dataID,* NeQuickModel2ParameterElement-r19: region parameters, *NavIC-ClockModel2* field descriptions, *NavModel-NavIC-KeplerianSet2* field descriptions, *AlmanacNavIC-AlmanacSet2* field descriptions, *UTC-ModelSet2* field descriptions, *KlobucharModelParamater* field descriptions, Field description for alfa2Ext-r19, alfa3Ext-r19, beta2Ext-r19, beta3Ext-r19.  The respective updates shall be incorporated in Phase 2 Draft CR |

* + 1. Phase 2 Discussion: CLOSED

The open items from Phase 1 discussion have been summarized below:

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| Qualcomm | *NavIC-GridModelParameter* 🡪 *navic-RefITOW*, *navic-RefTOI*  Why are these two new fields needed? They provide the same information as existing *navic-RefTOWC*.  The *NavIC-GridModelParameter* always provide the ionospheric delay for L5 frequency per section 6.2.2.3:  "Message type 5 contains the ionosphere grid corrections for grid points over Indian region. The ionospheric delay corrections are broadcasted as vertical delay estimates at specified Ionospheric Grid Points (IGPs), applicable to a signal on L5 for the single frequency users over  the Indian land mass."  Therefore, "This field is applicable for NavIC L1 receiver." is confusing/missleading and the existing time stamp TOWC seems enough.  The *navic-RefITOW*, *navic-RefTOI* are equivalent to the existing *navic-RefTOWC*, so it would be rather confusing/unclear if both are present.  If the receiver is operating on L1, the calculated ionospheric correction must be multiplied by the frequency ratio (see Annex D of ICD), but this does not affect the assistance data.  The same is also the case for the Klobuchar/NeQuick parameter. Even for L1 navigation message, the parameter are for the iono delay on L5 frequency and the receiver perfoms the frequency scaling, per Annex H and I of the ICD. (Ionospheric delay is frequency dependent, and therefore, the model parameter need to be clear for which frequency they apply. Except for NavIC, it's always L1. For NavIC it seems they are always for L5. Therefore, no changes should be needed here.) |
| Reliance Jio | *WRT NavIC-GridModelParameter* 🡪 *navic-RefITOW*, *navic-RefTOI*  The NavIC L5 & NavIC L1 messages use different timing representation. TOWC parameter is not available in NavIC L1 message.  The NavIC L1 message uses navic-RefITOW, navic-RefTOI parameters to convey the respective timestamp. Hence, its essential to provision these two parameters in case the GridModelParamaters are received as part of NavIC L1 message to provide relevant timestamp. |
| Qualcomm | Since the *GNSS-IonosphericModel* is common assistance data, it should be clarified (e.g., as IE introduction text) that the parameter are applied according to [xx] and provide the ionospheric delay on the L5 frequency (see Annex I of the ICD). This is essential to understand the corresponding *GNSS-IonosphericModelReq* at LMF correctly.  In the field description table, some sentences have no period at the end. |
| Reliance Jio | WRT *GNSS-IonosphericModel:*  Reference to L1 ICD [xx] shall be added to IE introduction text in Phase 2 Draft CR.  In our understanding a reference to NavIC L1 ICD specifies that Ionospheric model parameters received in NavIC L1 messages correspond to L5 frequency. Hence, it may not be explicitly stated in the stage 3 specification.  - This approach is consistent with Ionospheric model IE descriptions applicable to other GNSS where parameters are applicable for L1 frequency.  - This approach would also allow the use of same Ionospheric model IE by non-NavIC systems in future.  However, in case IMs are of a strong opinion that such detail is essential to be captured in stage 3 specification, we are open to explicitly specify that these “parameters provide the ionospheric delay on the L5 frequency” |

Companies are invited to provide their inputs wrt the changes proposed in *Phase2\_Draft\_R2-25xxxxx\_NavIC\_L1\_stage3\_CR* under 6.5.2.2 GNSS Assistance data Elements & above open items from Phase 1 discussion.

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| **Company** | **Remark** |
| Qualcomm | GNSS to svHealth Bit String(8) relation, Note 8:  Note 8: If *GNSS‑ID* indicates 'navic', and GNSS Orbit Model-9 is included, this interpretation of *svHealth* applies.  Why is this new Note needed? It seems not correct, since this interpretation also applies if Model-8 is included.  *GNSS-DataBitAssistance* field descriptions 🡪 ***gnss-DataBits:***  In the case of NavIC, it contains the FEC encoded and interleaved Navigation symbols as defined in [38].  In the case of NavIC L1, it contains the encoded and interleaved Navigation symbols as defined in [xx], clause 5.  This should be "NavIC L5".  *NavIC-GridModelParameter:*  I agree, the time representation used on NavIC L1 and L5 NAV message is different. However, the IE *NavIC-GridModelParameter* is coming from an LMF. Both representations result in the same time. For example, the IE *GNSS-ReferenceTime* provides the GNSS time as a Time-Of-Day for all GNSSs (*GNSS-SystemTime*), even though GPS, Galileo, BDS, NavIC, etc. uses a Time-Of-Week representation (TOW), slightly different in all GNSSs. However, a single representation for all GNSSs simplifies receiver handling.  If this complication is needed for the IE *NavIC-GridModelParameter,* then at least the field description needs to be corrected/clarified:  ***navic-RefTOWC***  "as received in NavIC L5 message" / "as received in NavIC L1 message": The UE receives this from an LMF. If the receiver would receive it from the NavIC L5 or L1 message, the whole assistance data is not needed.  "This field is applicable for NavIC L5 receiver." / "This field is applicable for NavIC L1 receiver": This field is applicable to a NavIC receiver, no matter which signal(s) the receiver supports. (actually, it can be applicable to any GNSS receiver, since the ionosphere is not GNSS dependent)  (Most likely, there is always a mix of signals used by a receiver. E.g., at least in a transition phase, not all SVs support L1, etc. Therefore, if one SV is measured on L5, and another SV on L1, what would the "NavIC L1 receiver" or "NavIC L5" receiver mean? The UE uses the parameter to calculate the ionospheric delay, which is not dependent on a "receiver" (i.e., will not calculate the same ionospheric delay twice in this mixed/dual-signal example).) |
| Reliance Jio | GNSS to svHealth Bit String(8) relation, Note 8:  Separate Health strings to be added for NavIC L5 & NavIC L1 with independent notes pointing to respective orbit models.  *GNSS-DataBitAssistance* field descriptions 🡪 ***gnss-DataBits:***  Agree. Field description updated in the editorials corrected in updated CR Phase2\_Draft\_R2-25xxxxx\_NavIC\_L1\_stage3\_CR-v1  *NavIC-GridModelParameter:*  With the understanding that a single frequency NavIC L1 (only) receiver can treat the LMF populated TOWC field solely as a Timestamp without any need for conversion to NavIC L1 timing representation, we are okay to de-prioritise the introduction of new L1 timing fields to this IE. Changes reflected in Phase2\_Draft\_R2-25xxxxx\_NavIC\_L1\_stage3\_CR-v1 |

* 1. GNSS Assistance Data Request Elements
     1. Phase 1 Discussion: CLOSED

Companies are invited to provide their inputs wrt the changes proposed in R2-2409726 under 6.5.2.4 GNSS Assistance Data Request Elements

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| **Company** | **Agree/Disagree** | **Remark** |
| Qualcomm |  | GNSS-AlmanacReq 🡪 modelID-Ext-r19:  This is an UL message; no Need Code is needed. |
| Reliance Jio |  | Agree with QC input. Change to be incorporated in Phase 2 Draft CR |
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* 1. GNSS Capability Information Elements
     1. Phase 1 Discussion: CLOSED

Companies are invited to provide their inputs wrt the changes proposed in R2-2409726 under 6.5.2.10 GNSS Capability Information Elements

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| **Company** | **Agree/Disagree** | **Remark** |
| Qualcomm |  | *GNSS-NavigationModelSupport:*  If the target device supports NavIC L5 and *GNSS-NavigationModel* assistance, it shall support *clockModel* Model-8.  If the target device supports NavIC L1 and *GNSS-NavigationModel* assistance, it shall support *clockModel* Model-9.  If the target device supports NavIC L5 and *GNSS-NavigationModel* assistance, it shall support *orbitModel* Model-8.  If the target device supports NavIC L1 and *GNSS-NavigationModel* assistance, it shall support *orbitModel* Model-9.  These changes introduce unnecessary new requirements and should be removed. NavIC L1 and L5 are not different GNSSs – the GNSS is still NavIC. To support NavIC L1, the device does not necessarily need to support Model-9. The same is the case for all other GNSSs, like GPS, QZSS, BDS, etc. The "mandatory" models are selected based on the "legacy models" (which all receivers support anyhow) which can also be used for any signal of the same GNSS. This change mixes "GNSS" and "GNSS signals". L1/L5 models are just slightly different parametrization of the orbit/clock, but no matter which parametrization is being used by the receiver, the result is the same: satellite position and clock offset. |
| Reliance Jio |  | Agree with QC input. Change to be incorporated in Phase 2 Draft CR |
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* 1. Common GNSS Information Elements
     1. Phase 1 Discussion: CLOSED

Companies are invited to provide their inputs wrt the changes proposed in R2-2409726 under 6.5.2.13 Common GNSS Information Elements

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| **Company** | **Agree/Disagree** | **Remark** |
| Qualcomm |  | *GNSS-SignalID, GNSS-SignalIDs*:  1 NavIC L1 SPS I  2 NavIC L1 SPS Q  3 NavIC L1 SPS I+Q  It is not clear what these components mean. NavIC L1 uses SBOC modulation (not plain BPSK) and contains a data and pilot signal (per section 3.3.2 of ICD).  This seems similar to e.g., GPS L1C. Therefore, this should probably be:  NavIC L1 SPS(D)  NavIC L1 SPS(P)  NavIC L1 SPS(D+P) |
| Reliance Jio |  | Agree with QC input. Change to be incorporated in Phase 2 Draft CR |
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* 1. Other comments
     1. Phase 1 Discussion: CLOSED

Companies are invited to provide their any further inputs, comments, or suggestions other than those covered under previous sections on the Stage 3 CR for Introduction of NavIC L1 A-GNSS in LPP

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| **Company** | **Remark** |
| Qualcomm | CR in R2-2409726 does not use the latest spec version.  Whole CR seems to use Normal Style.  Some field names in descriptions do not use Italic font style (e.g., alfa2Ext, etc.).  ASN extension suffix: It was clarified at last meeting, that SEQUENCE extensions should use the -r19 suffix (not -v19xy). |
| Reliance Jio | Agree with QC input. Change to be incorporated in Phase 2 Draft CR |
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* + 1. Phase 2 Discussion: CLOSED

Companies are invited to provide their any further inputs, comments, or suggestions other than those covered under previous sections on the Phase2\_Draft\_R2-25xxxxx\_NavIC\_L1\_stage3\_CR

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| **Company** | **Remark** |
| Qualcomm | Editorial:  - Section 2 in the CR has all Normal Style (incl. Heading)  - *KlobucharModelParamater* field descriptions: Field names like dataID, alfa2, etc. in the description should use Italic font. |
| Reliance Jio | The editorials corrected in updated CR Phase2\_Draft\_R2-25xxxxx\_NavIC\_L1\_stage3\_CR-v1 |
| Ericsson | NOTE 2 of the *GNSS-SSR-OrbitCorrections* IE should be also modified to also include a part that specifies that the corrections are related to the L1 broadcast ephemeris in case *gnss-ID* indicates 'navic-v1610'.  Example:  NOTE 2: In the cases that *gnss-ID* indicates 'gps', 'qzss', 'bds' or ‘navic-v1610’, the *iod* refers to the NAV broadcast ephemeris (GPS L1 C/A, QZSS QZS-L1, BDS B1I, or NavIC L1 respectively, in table GNSS to iod Bit String(11) relation in IE *GNSS‑NavigationModel).* |
| Reliance Jio | We concur with the suggestion towards updating the *GNSS-SSR-OrbitCorrections* IE note specifying that the L1 broadcast ephemeris in case *gnss-ID* indicates 'navic-v1610'. This can be discussed further at RAN2#129. |

1. Conclusion

The discussion above can be summarized in the form of the following proposals. The agreed items would be part of updated Stage 3 CR (Phase2\_Draft\_R2-25xxxxx\_NavIC\_L1\_stage3\_CR-v2):

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| Sr | Leading Proposals |
| 1 | NeQuickModel2ParameterElement-r19:  Parameters modipmax-r19, modipmin-r19, mLonmax-r19, and mLonmin-r19 should not be OPTIONAL.  CR to be updated. |
| 2 | *NavIC-GridModelParameter* 🡪 *navic-RefITOW*, *navic-RefTOI*  These two new fields may not be required.  It was agreed that the proposed new fields would be de-priortised, instead LMF to use TOWC timestamp for all receiver categories. |
| 3 | *GNSS-IonosphericModel:* NavIC message parameters correspond to Ionospheric corrections for L5 frequency. This needs to be reflected in Stage-3 specification.  It was decided that a reference to the NavIC L1 ICD serves this purpose. |
| 4 | *GNSS-SignalID, GNSS-SignalIDs*: component nomenclature to be updated as follows:  1 NavIC L1 SPS I to NavIC L1 SPS(D)  2 NavIC L1 SPS Q to NavIC L1 SPS(P)  3 NavIC L1 SPS I+Q to NavIC L1 SPS(D+P) |
| 5 | Following change to be removed:  *GNSS-NavigationModelSupport:*  If the target device supports NavIC L5 and *GNSS-NavigationModel* assistance, it shall support *clockModel* Model-8.  If the target device supports NavIC L1 and *GNSS-NavigationModel* assistance, it shall support *clockModel* Model-9. |
| 6 | NOTE 2 of the *GNSS-SSR-OrbitCorrections* IE should be also modified to also include a part that specifies that the corrections are related to the L1 broadcast ephemeris in case *gnss-ID* indicates 'navic-v1610'  To be included. Can be discussed further at RAN2#129 meeting. |
| 7 | Styles in R2-2409726 to be corrected as per Stage-3 specification requirement. Other editorial and minor changes- as discussed in Phase 1 & 2 - to be included in updated stage 3 CR. |