3GPP TSG-RAN WG2 #116-bis R2-21xxxxx

Electronic meeting, 2022-01-17 - 2021-01-25

Agenda Item: 8.21.2

Source: Ericsson

Title: Post116-e][087][TEI17] Explicit SI start position for SI Scheduling (Ericsson)

Document for: Discussion, Decision

# 1 1 Introduction

This document is to kick off the following email discussion:

* [Post116-e][087][TEI17] Explicit SI start position for SI Scheduling (Ericsson)

 Scope: Make progress, based on R2-2111248, and comments provided, e.g. in discussion R2-2111537. Include both problem aspects and solution aspects. Attempt to conclude for which scenarios in reality a solution is needed, Attempt to conclude on solution.

 Intended outcome: Report (can contain TP parts for solution discussion/report)

 Deadline: Dec 17

# 2 Contact Information

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| Company | Contact: Name (E-mail) |
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# 3 References

1. R2-2111248, " On the need of providing explicit SI start position for SI Scheduling ", Ericsson, Verizon, Deutsche Telekom, Softbank, Swift Navigation, ESA, T-Mobile USA.
2. R2-2110799, “SIB and posSIB scheduling constraints”, MediaTek Inc
3. R2-2111537, “[AT116-e][049][TEI17] TEI17 NR proposals RAN2 Chair”, MediaTek Inc.

# 4 Discussions

From [1] and [2] it is clear that a large extent of the functionality is based upon broadcast support. [1] shows that there can be up to 27 SIs that NW needs to consider for SI scheduling. [2] provides the view that realistic Rel-16 deployment could be expected to require ~12 SI messages, with the occasional addition of 1-2 SI messages for PWS. However, rapporteur’s view is that it does not really matter if PWS is “occasional” or not. If PWS is valid in a NW, then there is a need to incorporate the scheduling for it at the beginning anyhow, i.e. it will require 1-2 SI messages independently if/when it occurs. So realistically it should be ~14 SI messages as conclusion for [2].

Form both paper analysis, it is clear that the situation is severe in DSS based deployment and in addition deployment where posSIBs need to be broadcast. The current NR SI scheduling is constrained to the parameters shortest SI periodicity and configured SI Window length.

$$Number of SI=\frac{shortest SI Periodicty}{SI window length}$$

Further, the discussion here should not be short sighted; i.e NR will evolve for many years to come and it is expected every release there will be addition of new SIBs. Rel-17 is proposing to add around 10 more new SIBs (non-Positioning SIBs) and around 5 to 10 new positioning SIBs. Hence, any discussion (solution) should take this into consideration. For example, for Rel.17; below table shows the feature and corresponding new SIBs that are being proposed to be added.

|  |  |
| --- | --- |
| Features | Number of New SIBs  |
| MBS | 2 |
| UE Power Savings | 1 |
| NTN | 1 (at least) |
| MINT | 1 |
| NPN | 1 |
| Slicing | 1 (Tentative) |
| Sidelink | 1 |
| Positioning | 5 to 13 (NaVIC 2, Integrity 2 to 10, On-Demand PRS 1) |

## 4.1 NW Deployment where Constraints are seen

In this section, we attempt to gather input from companies (especially operators); on which sort of deployment do they see the problem:

1. In DSS deployment even without posSIBs
2. In DSS deployments with posSIBs
3. Non-DSS Deployments even without posSIBs (considering future releases will add more NR SIBs)
4. Non-DSS Deployment with posSIBs
5. All of the above
6. Any other, please mention in the comments

**Question 1: Companies are invited to provide input on which NW deployment they see the severity of the issue?**

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## 4.2 How to solve the problem

In RRC specification, positioning SIBs are inserted in positioning Scheduling list for scheduling which is different than the NR scheduling list. It is possible to partially limit the problem by only considering the SI scheduling for positioning SIBs; i.e only SIs that would be scheduled via positioning scheduling list from Rel-16. Further, it is possible to partially limit the problem by only considering NR SIBs (any new NR SIBs from Rel-17). It is further possible to solve the SI scheduling problem for both NR Rel-17 SIBs and NR Rel-16 posSIBs using a common scheduling list.

Note: Here it is assumed that, there will be no impact for NR Rel-15 and NR Rel-16 SIBs apart from positioning SIBs which were introduced in Rel-16.

There is possibility to provide solution to:

1. only provide solution to limit the problem for posSI scheduling from Rel-16 (Motivation ([6.1](#_6.1_Motivation)) including brief description of solution ([6.2](#_6.2_Brief_Description)) and (Text Proposal) ([6.3](#_6.3_Solution)): [Annex A](#_6_Annex_A) Offset based)
2. combined solution for positioning SIBs from Rel-16 and NR SIBs from Rel-17 (Motivation ([7.1](#_7.1_Motivation)) including brief description of solution ([7.2](#_7.2_Solution)) and Text Proposal ([7.3](#_7.3_Solution)): [Annex B](#_7.2_Solution_1) Explicit Indication)
3. both a and b; where for b the SIBs considered are from Rel-17; i.e combined Solution for NR Rel-17 SIBs and positioning SIBs from Rel-17
4. only provide solution to limit the problem for posSI scheduling from Rel-16 with maging sentence so that the existing offsetToSI-Used is simply applied based on the shortest configured SI periodicity, rather than on the fixed value of 80 ms. This solution is simplified version of solution a) with minimum spec change
5. only provide solution to limit the problem considering new SIBs added from Rel-17 as solution provided in [Annex B](#_7.2_Solution_1) but without Rel-16 posSIBs.

**Question 2: Companies are invited to provide input on which option is preferred.**

**Note: The final outcome of the selected solution would be dependent upon 4.1**

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## 4.3 80ms Offset

One question that RAN2 should answer is whether it is ok to remove (dummy) the 80ms offset based solution if one of the above solutions (a or b) gets agreed.

**Question 3: Companies are invited to provide input on whether the 80ms offset can be removed; if the solution a or b gets agreed.**

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## 4.4 Any other comments

**Question 4: Companies are invited to provide any additional input/comments.**

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# 5 Conclusion

Based on the discussion in the previous sections we propose the following:

# 6 Annex A

### 6.1 Motivation

Correction for Offset based solution (replacing hardcoded 80ms with configurable shortest SI periodicity) may help alleviate problem for scheduling positioning SIs in certain deployment where large SI Periodicity and large SI Window length is configured (for example in some NR deployment and DSS based deployments).

### 6.2 Brief Description of Solution

In order to be backward compatible, a new positioning scheduling list is proposed which schedules the positioning SI with an offset of shortest configured SI Periodicity.

### 6.3 Text Proposal

##### 5.2.2.3.2 Acquisition of an SI message

For SI message acquisition PDCCH monitoring occasion(s) are determined according to *searchSpaceOtherSystemInformation*. If *searchSpaceOtherSystemInformation* is set to zero, PDCCH monitoring occasions for SI message reception in SI-window are same as PDCCH monitoring occasions for *SIB1* where the mapping between PDCCH monitoring occasions and SSBs is specified in TS 38.213[13]. If *searchSpaceOtherSystemInformation* is not set to zero, PDCCH monitoring occasions for SI message are determined based on search space indicated by *searchSpaceOtherSystemInformation*. PDCCH monitoring occasions for SI message which are not overlapping with UL symbols (determined according to *tdd-UL-DL-ConfigurationCommon*) are sequentially numbered from one in the SI window. The [x×N+K]th PDCCH monitoring occasion (s) for SI message in SI-window corresponds to the Kth transmitted SSB, where x = 0, 1, ...X-1, K = 1, 2, …N, N is the number of actual transmitted SSBs determined according to *ssb-PositionsInBurst* in *SIB1* and X is equal to CEIL(number of PDCCH monitoring occasions in SI-window/N). The actual transmitted SSBs are sequentially numbered from one in ascending order of their SSB indexes. The UE assumes that, in the SI window, PDCCH for an SI message is transmitted in at least one PDCCH monitoring occasion corresponding to each transmitted SSB and thus the selection of SSB for the reception SI messages is up to UE implementation.

When acquiring an SI message, the UE shall:

1> determine the start of the SI-window for the concerned SI message as follows:

2> if the concerned SI message is configured in the *schedulingInfoList*

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the list of SI messages configured by *schedulingInfoList* in *si-SchedulingInfo* in *SIB1*;

3> determine the integer value *x = (n – 1) × w*, where *w* is the *si-WindowLength*;

3> the SI-window starts at the slot #*a*, where *a* = *x* mod N, in the radio frame for which SFN mod *T* = FLOOR(*x*/N), where *T* is the *si-Periodicity* of the concerned SI message and N is the number of slots in a radio frame as specified in TS 38.213 [13];

2> else if the concerned SI message is configured in the *posSchedulingInfoList* and neither *offsetToSI-Used* nor *shortestOffsetToSI-Used* is configured:

3> create a concatenated list of SI messages by appending the *posSchedulingInfoList* in *posSI-SchedulingInfo* in *SIB1* to *schedulingInfoList* in *si-SchedulingInfo* in *SIB1*;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the concatenated list;

3> determine the integer value *x = (n – 1) × w*, where *w* is the *si-WindowLength*;

3> the SI-window starts at the slot #*a*, where *a* = *x* mod N, in the radio frame for which SFN mod *T* = FLOOR(*x*/N), where *T* is the *posSI-Periodicity* of the concerned SI message and N is the number of slots in a radio frame as specified in TS 38.213 [13];

2> else if the concerned SI message is configured by the *posSchedulingInfoList* and *offsetToSI-Used* is configured:

3> determine the number *m* which corresponds to the number of SI messages with an associated *si-Periodicity* of 8 radio frames (80 ms), configured by *schedulingInfoList* in *SIB1*;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the list of SI messages configured by *posSchedulingInfoList* in *SIB1*;

3> determine the integer value *x* = *m* *× w +* (*n* – 1*)* *× w*, where *w* is the *si-WindowLength*

3> the SI-window starts at the slot #*a*, where *a* = *x* mod N, in the radio frame for which SFN mod *T* = FLOOR(*x*/N) +8, where *T* is the *posSI-Periodicity* of the concerned SI message and N is the number of slots in a radio frame as specified in TS 38.213 [13];

2> else if the concerned SI message is configured by the *posSchedulingInfoList2* and *shortestOffsetToSI-Used* is configured:

3> determine the number *m* which corresponds to the number of SI messages with an associated shortest *si-Periodicity* configured by *schedulingInfoList* in *SIB1*;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the list of SI messages configured by *posSchedulingInfoList* in *SIB1*;

3> determine the integer value *x* = *m* *× w +* (*n* – 1*)* *× w*, where *w* is the *si-WindowLength*

3> the SI-window starts at the slot #*a*, where *a* = *x* mod N, in the radio frame for which SFN mod *T* = FLOOR(*x*/N) + shortest *si-Periodicity*, where *T* is the *posSI-Periodicity* of the concerned SI message and N is the number of slots in a radio frame as specified in TS 38.213 [13];

1> receive the PDCCH containing the scheduling RNTI, i.e. SI-RNTI in the PDCCH monitoring occasion(s) for SI message acquisition, from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength*, or until the SI message was received;

1> if the SI message was not received by the end of the SI-window, repeat reception at the next SI-window occasion for the concerned SI message in the current modification period;

NOTE 1: The UE is only required to acquire broadcasted SI message if the UE can acquire it without disrupting unicast data reception, i.e. the broadcast and unicast beams are quasi co-located.

NOTE 2: The UE is not required to monitor PDCCH monitoring occasion(s) corresponding to each transmitted SSB in SI-window.

NOTE 3: If the concerned SI message was not received in the current modification period, handling of SI message acquisition is left to UE implementation.

NOTE 4: A UE in RRC\_CONNECTED may stop the PDCCH monitoring during the SI window for the concerned SI message when the requested SIB(s) are acquired.

NOTE 5: A UE capable of NR sidelink communication and configured by upper layers to perform NR sidelink communication on a frequency, may acquire *SIB12* from a cell other than current serving cell (for RRC\_INACTIVE or RRC\_IDLE) or current PCell (for RRC\_CONNECTED), if *SIB12* of current serving cell (for RRC\_INACTIVE or RRC\_IDLE) or current PCell (for RRC\_CONNECTED) does not provide configuration for NR sidelink communication for the frequency, and if the other cell providing configuration for NR sidelink communication for the frequency meets the S-criteria as defined in TS 38.304 [20] and TS 36.304 [27].

1> perform the actions for the acquired SI message as specified in sub-clause 5.2.2.4.

*<Unmodified sections omitted>*

*<Unmodified sections omitted>*

#### – *PosSI-SchedulingInfo*

-- ASN1START

-- TAG-POSSI-SCHEDULINGINFO-START

PosSI-SchedulingInfo-r16 ::= SEQUENCE {

 posSchedulingInfoList-r16 SEQUENCE (SIZE (1..maxSI-Message)) OF PosSchedulingInfo-r16,

 posSI-RequestConfig-r16 SI-RequestConfig OPTIONAL, -- Cond MSG-1

 posSI-RequestConfigSUL-r16 SI-RequestConfig OPTIONAL, -- Cond SUL-MSG-1

 ... ,

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 posSchedulingInfoList2-r17 SEQUENCE (SIZE (1..maxSI-Message)) OF PosSchedulingInfo2-r17 OPTIONAL -– Need R

 shortestOffsetToSI-Used-r17 ENUMERATED {true} OPTIONAL, -- Need R

 ]]

}

PosSchedulingInfo-r16 ::= SEQUENCE {

 offsetToSI-Used-r16 ENUMERATED {true} OPTIONAL, -- Need R

 posSI-Periodicity-r16 ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},

 posSI-BroadcastStatus-r16 ENUMERATED {broadcasting, notBroadcasting},

 posSIB-MappingInfo-r16 PosSIB-MappingInfo-r16,

 ...

}

PosSchedulingInfo2-r17 ::= SEQUENCE {

 posSI-BroadcastStatus-r17 ENUMERATED {broadcasting, notBroadcasting},

 posSI-Periodicity-r17 ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},

 posSIB-MappingInfo-r17 PosSIB-MappingInfo-r16

}

PosSIB-MappingInfo-r16 ::= SEQUENCE (SIZE (1..maxSIB)) OF PosSIB-Type-r16

PosSIB-Type-r16 ::= SEQUENCE {

 encrypted-r16 ENUMERATED { true } OPTIONAL, -- Need R

 gnss-id-r16 GNSS-ID-r16 OPTIONAL, -- Need R

 sbas-id-r16 SBAS-ID-r16 OPTIONAL, -- Need R

 posSibType-r16 ENUMERATED { posSibType1-1, posSibType1-2, posSibType1-3, posSibType1-4, posSibType1-5, posSibType1-6,

 posSibType1-7, posSibType1-8, posSibType2-1, posSibType2-2, posSibType2-3, posSibType2-4,

 posSibType2-5, posSibType2-6, posSibType2-7, posSibType2-8, posSibType2-9, posSibType2-10,

 posSibType2-11, posSibType2-12, posSibType2-13, posSibType2-14, posSibType2-15,

 posSibType2-16, posSibType2-17, posSibType2-18, posSibType2-19, posSibType2-20,

 posSibType2-21, posSibType2-22, posSibType2-23, posSibType3-1, posSibType4-1,

 posSibType5-1,posSibType6-1, posSibType6-2, posSibType6-3,... },

 areaScope-r16 ENUMERATED {true} OPTIONAL -- Need S

}

GNSS-ID-r16 ::= SEQUENCE {

 gnss-id-r16 ENUMERATED{gps, sbas, qzss, galileo, glonass, bds, ...},

 ...

}

SBAS-ID-r16 ::= SEQUENCE {

 sbas-id-r16 ENUMERATED { waas, egnos, msas, gagan, ...},

 ...

}

-- TAG-POSSI-SCHEDULINGINFO-STOP

-- ASN1STOP

|  |
| --- |
| *PosSI-SchedulingInfo* field descriptions |
| ***areaScope***Indicates that a posSIB is area specific. If the field is absent, the posSIB is cell specific. |
| ***encrypted***The presence of this field indicates that the *pos-sib-type* is encrypted as specified in TS 37.355 [49]. |
| ***gnss-id***The presence of this field indicates that the positioning SIB type is for a specific GNSS. Indicates a specific GNSS (see also TS 37.355 [49]) |
| ***posSI-BroadcastStatus***Indicates if the SI message is being broadcasted or not. Change of *posSI-BroadcastStat*us should not result in system information change notifications in Short Message transmitted with P-RNTI over DCI (see clause 6.5). The value of the indication is valid until the end of the BCCH modification period when set to *broadcasting*. |
| ***posSI-RequestConfig***Configuration of Msg1 resources that the UE uses for requesting SI-messages for which *posSI-BroadcastStatus* is set to notBroadcasting. |
| ***posSI-RequestConfigSUL***Configuration of Msg1 resources that the UE uses for requesting SI-messages for which *posSI-BroadcastStatus* is set to notBroadcasting. |
| ***ShortestOffsetToSI-Used***This field, if present indicates that the SI messages in *posSchedulingInfoList* are scheduled with an offset of shortest configured *posSI-Periodicity* compared to SI messages in *schedulingInfoList*. *shortestoffsetToSI-Used* may be present only if *offsetToSI-Used* is absent. |
| ***posSIB-MappingInfo***List of the posSIBs mapped to this *SystemInformation* message. |
| ***posSibType***The positioning SIB type is defined in TS 37.355 [49]. |
| ***posSI-Periodicity***Periodicity of the SI-message in radio frames, such that rf8 denotes 8 radio frames, rf16 denotes 16 radio frames, and so on. If the *offsetToSI-Used* is configured, the *posSI-Periodicity* of rf8 cannot be used. |
| ***offsetToSI-Used***This field, if present indicates that the SI messages in *posSchedulingInfoList* are scheduled with an offset of 8 radio frames compared to SI messages in *schedulingInfoList*. *offsetToSI-Used* may be present only if the shortest configured SI message periodicity for SI messages in *schedulingInfoList* is 80ms. |
| ***sbas-id***The presence of this field indicates that the positioning SIB type is for a specific SBAS. Indicates a specific SBAS (see also TS 37.355 [49]). |

| Conditional presence | Explanation |
| --- | --- |
| *MSG-1* | The field is optionally present, Need R, if *posSI-BroadcastStatus* is set to *notBroadcasting* for any SI-message included in *PosSchedulingInfo*. It is absent otherwise. |
| *SUL-MSG-1* | The field is optionally present, Need R, if *supplementaryUplink* is configured in *ServingCellConfigCommonSIB* and if *posSI-BroadcastStatus* is set to *notBroadcasting* for any SI-message included in *PosSchedulingInfo*. It is absent otherwise. |

# **7** Annex B

### 7.1 Motivation

Explicit Indication based solution allows NW to calculate the necessary offset (i.e avoid collision) and provide the start position of SI to UE. It can create more rooms for SI scheduling than offset based. The offset based solution is limited to positioning whereas explicit Indication can be for both.

The offset based solution can at max create room for ($\frac{shortest SI Periodicty}{SI window length} -1$) number of SI whereas the explicit indication based can create more room for SI scheduling than offset based solution.

### 7.2 Brief Description of Solution

In order to minimize the overhead with different scheduling lists, a common scheduling list is proposed which contains SIB types of both NR SIBs (Non-Positioning SIBs) and Positioning SIBs. NW indicates the start position of each SI. Of-course, SI is not mixed with non-positioning and positioning SIB types. They will be in separate SIs.

### 7.3 Text Proposal

##### 5.2.2.3.2 Acquisition of an SI message

For SI message acquisition PDCCH monitoring occasion(s) are determined according to *searchSpaceOtherSystemInformation*. If *searchSpaceOtherSystemInformation* is set to zero, PDCCH monitoring occasions for SI message reception in SI-window are same as PDCCH monitoring occasions for *SIB1* where the mapping between PDCCH monitoring occasions and SSBs is specified in TS 38.213[13]. If *searchSpaceOtherSystemInformation* is not set to zero, PDCCH monitoring occasions for SI message are determined based on search space indicated by *searchSpaceOtherSystemInformation*. PDCCH monitoring occasions for SI message which are not overlapping with UL symbols (determined according to *tdd-UL-DL-ConfigurationCommon*) are sequentially numbered from one in the SI window. The [x×N+K]th PDCCH monitoring occasion (s) for SI message in SI-window corresponds to the Kth transmitted SSB, where x = 0, 1, ...X-1, K = 1, 2, …N, N is the number of actual transmitted SSBs determined according to *ssb-PositionsInBurst* in *SIB1* and X is equal to CEIL(number of PDCCH monitoring occasions in SI-window/N). The actual transmitted SSBs are sequentially numbered from one in ascending order of their SSB indexes. The UE assumes that, in the SI window, PDCCH for an SI message is transmitted in at least one PDCCH monitoring occasion corresponding to each transmitted SSB and thus the selection of SSB for the reception SI messages is up to UE implementation.

When acquiring an SI message, the UE shall:

1> determine the start of the SI-window for the concerned SI message as follows:

2> if the concerned SI message is configured in the *schedulingInfoList*

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the list of SI messages configured by *schedulingInfoList* in *si-SchedulingInfo* in *SIB1*;

3> determine the integer value *x = (n – 1) × w*, where *w* is the *si-WindowLength*;

3> the SI-window starts at the slot #*a*, where *a* = *x* mod N, in the radio frame for which SFN mod *T* = FLOOR(*x*/N), where *T* is the *si-Periodicity* of the concerned SI message and N is the number of slots in a radio frame as specified in TS 38.213 [13];

2> else if the concerned SI message is configured in the *explicitschedulingInfoList*

3> determine the integer value *x = (si-WindowStart -1) × w*, where *w* is the *si-WindowLength*;

3> the SI-window starts at the slot #*a*, where *a* = *x* mod N, in the radio frame for which SFN mod *T* = FLOOR(*x*/N), where *T* is the *si-Periodicity* of the concerned SI message and N is the number of slots in a radio frame as specified in TS 38.213 [13];

2> else if the concerned SI message is configured in the *posSchedulingInfoList* and *offsetToSI-Used* is not configured:

3> create a concatenated list of SI messages by appending the *posSchedulingInfoList* in *posSI-SchedulingInfo* in *SIB1* to *schedulingInfoList* in *si-SchedulingInfo* in *SIB1*;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the concatenated list;

3> determine the integer value *x = (n – 1) × w*, where *w* is the *si-WindowLength*;

3> the SI-window starts at the slot #*a*, where *a* = *x* mod N, in the radio frame for which SFN mod *T* = FLOOR(*x*/N), where *T* is the *posSI-Periodicity* of the concerned SI message and N is the number of slots in a radio frame as specified in TS 38.213 [13];

2> else if the concerned SI message is configured by the *posSchedulingInfoList* and *offsetToSI-Used* is configured:

3> determine the number *m* which corresponds to the number of SI messages with an associated *si-Periodicity* of 8 radio frames (80 ms), configured by *schedulingInfoList* in *SIB1*;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the list of SI messages configured by *posSchedulingInfoList* in *SIB1*;

3> determine the integer value *x* = *m* *× w +* (*n* – 1*)* *× w*, where *w* is the *si-WindowLength*

3> the SI-window starts at the slot #*a*, where *a* = *x* mod N, in the radio frame for which SFN mod *T* = FLOOR(*x*/N) +8, where *T* is the *posSI-Periodicity* of the concerned SI message and N is the number of slots in a radio frame as specified in TS 38.213 [13];1> receive the PDCCH containing the scheduling RNTI, i.e. SI-RNTI in the PDCCH monitoring occasion(s) for SI message acquisition, from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength*, or until the SI message was received;

1> if the SI message was not received by the end of the SI-window, repeat reception at the next SI-window occasion for the concerned SI message in the current modification period;

NOTE 1: The UE is only required to acquire broadcasted SI message if the UE can acquire it without disrupting unicast data reception, i.e. the broadcast and unicast beams are quasi co-located.

NOTE 2: The UE is not required to monitor PDCCH monitoring occasion(s) corresponding to each transmitted SSB in SI-window.

NOTE 3: If the concerned SI message was not received in the current modification period, handling of SI message acquisition is left to UE implementation.

NOTE 4: A UE in RRC\_CONNECTED may stop the PDCCH monitoring during the SI window for the concerned SI message when the requested SIB(s) are acquired.

NOTE 5: A UE capable of NR sidelink communication and configured by upper layers to perform NR sidelink communication on a frequency, may acquire *SIB12* from a cell other than current serving cell (for RRC\_INACTIVE or RRC\_IDLE) or current PCell (for RRC\_CONNECTED), if *SIB12* of current serving cell (for RRC\_INACTIVE or RRC\_IDLE) or current PCell (for RRC\_CONNECTED) does not provide configuration for NR sidelink communication for the frequency, and if the other cell providing configuration for NR sidelink communication for the frequency meets the S-criteria as defined in TS 38.304 [20] and TS 36.304 [27].

1> perform the actions for the acquired SI message as specified in sub-clause 5.2.2.4.

*<Unmodified sections omitted>*

#### – *SI-SchedulingInfo*

The IE *SI-SchedulingInfo* contains information needed for acquisition of SI messages.

*SI-SchedulingInfo* information element

-- ASN1START

-- TAG–SI-SCHEDULINGINFO-START

SI-SchedulingInfo ::= SEQUENCE {

 schedulingInfoList SEQUENCE (SIZE (1..maxSI-Message)) OF SchedulingInfo,

 si-WindowLength ENUMERATED {s5, s10, s20, s40, s80, s160, s320, s640, s1280},

 si-RequestConfig SI-RequestConfig OPTIONAL, -- Cond MSG-1

 si-RequestConfigSUL SI-RequestConfig OPTIONAL, -- Cond SUL-MSG-1

 systemInformationAreaID BIT STRING (SIZE (24)) OPTIONAL, -- Need R

 ..., explicitSchedulingInfoList-r17 SEQUENCE (SIZE (1..maxSI-Message)) OF ExplicitSchedulingInfo-r17 OPTIONAL -– Need R

}

SchedulingInfo ::= SEQUENCE {

 si-BroadcastStatus ENUMERATED {broadcasting, notBroadcasting},

 si-Periodicity ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},

 sib-MappingInfo SIB-Mapping

}

ExplictSchedulingInfo-r17 ::= SEQUENCE {

 si-BroadcastStatus-r17 ENUMERATED {broadcasting, notBroadcasting},

 si-WindowStart-r17 INTEGER (1..128),

 si-Periodicity-r17 ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},

 si-MappingInfo-r17 SIB-Mapping-r17

}

SIB-Mapping ::= SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo

SIB-Mapping-r17 ::= SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo-r17

SIB-TypeInfo ::= SEQUENCE {

 type ENUMERATED {sibType2, sibType3, sibType4, sibType5, sibType6, sibType7, sibType8, sibType9,

 sibType10-v1610, sibType11-v1610, sibType12-v1610, sibType13-v1610, sibType14-v1610,

 spare3, spare2, spare1,... },

 valueTag INTEGER (0..31) OPTIONAL, -- Cond SIB-TYPE

 areaScope ENUMERATED {true} OPTIONAL -- Need S

}

SIB-TypeInfo-r17 ::= SEQUENCE {

 sibType-r17 CHOICE {

 type1-r17 ENUMERATED {sibTypeMBS1, sibTypeMBS2, sibTypePowerSaving, sibTypeMINT,sibTypeNPN, sibTypeNTN...}

 type2-r17 SEQUENCE {

 posSIBType-r17 ENUMERATED {posSibType1-1, posSibType1-2, posSibType1-3, posSibType1-4, posSibType1-5, posSibType1-6,

 posSibType1-7, posSibType1-8, posSibType2-1, posSibType2-2, posSibType2-3, posSibType2-4,

 posSibType2-5, posSibType2-6, posSibType2-7, posSibType2-8, posSibType2-9, posSibType2-10,

 posSibType2-11, posSibType2-12, posSibType2-13, posSibType2-14, posSibType2-15,

 posSibType2-16, posSibType2-17, posSibType2-18, posSibType2-19, posSibType2-20,

 posSibType2-21, posSibType2-22, posSibType2-23, posSibType3-1, posSibType4-1,

 posSibType5-1,posSibType6-1, posSibType6-2, posSibType6-3,... }

 encrypted-r17 ENUMERATED { true } OPTIONAL, -- Need R

 gnss-id-r17 GNSS-ID-r16 OPTIONAL, -- Need R

 sbas-id-r17 SBAS-ID-r16 OPTIONAL, -- Need R

 }

 valueTag-r17 INTEGER (0..31) OPTIONAL, -- Cond SIB-TYPE areaScope-r17 ENUMERATED {true} OPTIONAL -- Need S

}

-- TAG-SI-SCHEDULINGINFO-STOP

-- ASN1STOP

|  |
| --- |
| *SchedulingInfo* field descriptions |
| ***areaScope***Indicates that a SIB is area specific. If the field is absent, the SIB is cell specific. |
| ***si-BroadcastStatus***Indicates if the SI message is being broadcasted or not. Change of *si-BroadcastStat*us should not result in system information change notifications in Short Message transmitted with P-RNTI over DCI (see clause 6.5). The value of the indication is valid until the end of the BCCH modification period when set to *broadcasting*. |
| ***si-Periodicity***Periodicity of the SI message in radio frames. Value *rf8* corresponds to 8 radio frames, value *rf16* corresponds to 16 radio frames, and so on. |

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| --- |
| *SI-RequestResources* field descriptions |
| ***ra-AssociationPeriodIndex***Index of the association period in the si-RequestPeriod in which the UE can send the SI request for SI message(s) corresponding to this *SI-RequestResources*, using the preambles indicated by *ra-PreambleStartIndex* and rach occasions indicated by *ra-ssb-OccasionMaskIndex*. |
| ***ra-PreambleStartIndex***If N SSBs are associated with a RACH occasion, where N > = 1, for the i-th SSB (i=0, …, N-1) the preamble with preamble index = *ra-PreambleStartIndex* + i is used for SI request; For N < 1, the preamble with preamble index = *ra-PreambleStartIndex* is used for SI request. |

|  |
| --- |
| *SI-SchedulingInfo* field descriptions |
| ***si-RequestConfig***Configuration of Msg1 resources that the UE uses for requesting SI-messages for which *si-BroadcastStatus* is set to notBroadcasting. |
| ***si-RequestConfigSUL***Configuration of Msg1 resources that the UE uses for requesting SI-messages for which *si-BroadcastStatus* is set to notBroadcasting. |
| ***si-WindowLength***The length of the SI scheduling window. Value *s5* corresponds to 5 slots, value *s10* corresponds to 10 slots and so on. The network always configures *si-WindowLength* to be shorter than or equal to the *si-Periodicity*. |
| ***systemInformationAreaID***Indicates the system information area that the cell belongs to, if any. Any SIB with *areaScope* within the SI is considered to belong to this *systemInformationAreaID*. The systemInformationAreaID is unique within a PLMN. |

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| --- |
| *ExplicitSchedulingInfo* field descriptions |
| ***encrypted***The presence of this field indicates that the pos-sib-type is encrypted as specified in TS 37.355 [49]. |
| ***gnss-id***The presence of this field indicates that the positioning SIB type is for a specific GNSS. Indicates a specific GNSS (see also TS 37.355 [49]) |
| ***posSibType***The positioning SIB type is defined in TS 37.355 [49] mapped to SI for scheduling using*explicitSchedulingInfoList*. |
| ***type1***The SIBs mapped to SI for scheduling using*explicitSchedulingInfoList*. |
| ***sbas-id***The presence of this field indicates that the positioning SIB type is for a specific SBAS. Indicates a specific SBAS (see also TS 37.355 [49]). |