Source:	**NTT DOCOMO, INC. (Rapporteur)**
Title:	**Email discussion report on [91#30][LTE/DCe] SFN/subframe offset reporting**
Document for:	**Discussion and decision**
Agenda Item:	**7.8.1**

1. Introduction

This email discussion "[91#30][LTE/DCe] SFN/subframe offset reporting" aims to collect companies view and have common understanding on the SFN/Subframe reporting in DC. It should be noted that the outcome from RAN4 [1] will be also taken into account. This paper reports the summary of the discussion.

2. Discussion

As listed in [2], the rapporteur provides the discussion points which are divided in 4 sections. Companies are invited to express their views on each point.

- ➢ Potential Scenario (section 2.1)
- ➢ Signalling design (section2.2)
- ➢ Report contents (section2.3)
- ➢ Others (section2.4)

2.1. Potential scenario

Firstly, it is worth having common understanding on potential scenarios of SFN/subframe offset reporting. As the potential scenario, followings are listed in [2]

Case 1: When the UE is not configured with DC and is in vicinity to the SeNB coverage, the UE reports the SFN/subframe offset of the target PSCell to the MeNB. The offset information is used to align with DRX and measurement gap settings from the beginning when the SeNB is added to the UE. Furthermore, it can be used for the MeNB to decide an applicable power control mode (mode 1 or 2), depending on the available granularity of the SFN/subframe offset.

Case 2: While the UE is configured with DC, the UE reports the SFN/subframe offset between PCell and PSCell to the MeNB. The offset information is used to align with DRX and measurement gap setting after the SeNB is added to the UE. In addition, it is used to maintain the SFN/subframe offset in the NW side. Likewise, it can be used for the MeNB to decide an applicable power control mode.

The question is which scenario needs to be considered to design this functionality.

Q1: Which scenario should be considered, Case 1 and/or Case 2 and/or (if any) other case?

Company	Case1 and/or Case2	Remarks
NEC	Case 2	For Case 1, it is not so clear how and when the UE can know the target PSCell. In this case, the target cell is a "potential" PSCell, which will be configured as PSCell later? Instead of Case 1, Case 3 below may be an alternative:

		Case 3: When the UE receives RRC Connection Reconfiguration message including PSCell configuration, the UE reports the SFN/subframe offset of the target PSCell to the MeNB. (Exact timing of acquiring SFN/subframe of PSCell is FFS.)
CATT	Case2	In general, we think both case 1 and case 2 should work, but case 2 better reflects the current RAN4 agreements.
Nokia	Case 1 & 2	Before configuring DC, there is no target PSCell for the UE, only cells to be measured.
ETRI	Case 2	Main scenario is Case 1 and Case 3 provided by NEC is feasible.
ITRI	Case 2	Case 2 shall be considered with the first priority. Instead, Case 1 is a kind of optimization to get the offset information before the first DC configuration, and the benefits should be further discussed.
ZTE	Case 1 & 2	The offset should be known before configuring DC, as the measurement and DRX configuration can be sent in the HO command.
Intel	Case 1 and Case 2	
Alacatel-Lucent/ Alcatel-Lucent Shanghai Bell	Case 1, Case 2,	SFN and subframe offset setting is system parameters and does not depend on the UE or configuration of DC or not. And also these network parameters are not likely to change frequently. Therefore, the network should be able to request the UE for SFN and subframe offset between two given eNBs when its needed. The UE, if requested, is required to provide the SFN and subframe offset values to the network.
Ericsson	Both+	In addition to Case 1 and Case 2 it should also be supported that a UE configured with DC reports SFN/subframe offset between the PCell and **another cell** (other than the current PSCell and this other cell may belong to another eNB than the PSCell). This is useful to determine whether that other cell can be used as PSCell instead of the current PSCell. Maybe the intention was that this is covered by Case 1, even though not explicitly written?
MediaTek	Case 2	In current R-12 DuCo, decoding MIB to get SFN number is part of configuration/activation procedure. And the UE surely can know the subframe timing difference during activation. Since the offset is changing with UE mobility, the benefit of early report is not clear. In addition, for case 1 if the UE is not configured with DC, it only needs to decode MIB during measurement in pSCell, which is different from existing CGI acquisition, it needs to decode both MIB and SIB1. A new measurement shall be defined.
LG	Case 1 and 2	There is no target PSCell when DC is not configured.
Qualcomm Incorporated	Case2	For case 1, the acquisition of SFN for a non-configured cell requires a special measurement like SI-reading for CSG cell inbound mobility. We believe the MeNB can learn the SFN/subframe time difference like SON and the procedure outlined in the case 2 is sufficient.
Samsung	Case 1 and 2	We assume to reuse the existing measurement mechanism with a small modification. Then the UE will report the SFN offset information to the network regardless of cases whenever the network configures the reporting.

Huawei, HiSilicon		It is beneficial for the network to know the SFN offset before configuring DC to the UE, but when the network needs to get it will be related to whether SFN offset is stable? And what accurate requirement would be? For instance if SFN offset is stable or the accurate SFN offset , then we can just use SON liked mechanism. If not, case 1 and 2 shall be supported, in addition, the network may need to get SFN offset periodically for case 2.
NTT DOCOMO	Case1 and Case2	

Rapporteur's summary

For Case1, some companies are not convinced the benefit to support and others considers it should be allowed that NW can indicate UE to report whenever it wants UE to do so. For Case2, most companies agree to support. It is questioned by a company how and when UE reports SFN/subframe offset in Case1 and it was also.commented that it will depend on how stable the timing offset when NW should obtain the offset from UE. Moreover, it is suggested that UE reports SFN/subrame offset for another cell (other than the current PSCell and this other cell may belong to another eNB than the PSCell). Originally, the rapporteur's intention of the Case1 and 2 is to clarify whether to support measurement/report in non-DC state and/or in DC state. However, based on the views from companies, the rapporteur understood that we need to consider the combination of the UE state and the target cell(s) to measure/report as described in following table.

UE state	PSCell	Serving cell(s) in SCG other than PSCell	Non-serving cell(s)
Non-DC	N/A	N/A	Case1
DC	Case2	Case 3	Case 4

NOTE: "Case3" in above table does not indicate "Case3" in remark from NEC

Based on the majority companies' view to support case2, it can be concluded that the UE needs to report SFN/subframe offset for PSCell when DC is configured.

Proposal1: UE needs to report SFN/subframe offset for PSCell when DC is configured.

Considering Case1, 8 companies (+ETRI?) are supportive to consider and 1 company (CATT) think the mechanism should work. Therefore, the rapporteur proposes to support Case1. It should be noted how and when UE reports in Case1 as pointed out by NEC will be clarified futher.

Proposal1a: UE needs to report SFN/subframe offset for non-serving cell when DC is not configured.

Regarding the additional cases pointed out by Ericsson (Case 3/4 in the table), the email discussion was not sufficient to come to a decision. The rapporteur proposes to discuss it further.

Proposal1b: Discuss whether UE needs to report SFN/subframe offset for the cell other than PSCell when DC is configured (Case 3/4).

2.2. Signalling design

For SFN/subframe reporting, the UE needs to acquire SFN/subframe from MIB of PSCell and reports the offset of SFN/subframe between PCell and PSCell. Regarding acquiring SFN/subframe of PSCell, since there is no existing mechanism for that, the additional mechanism will be needed. As such a mechanism, there will be 2 options,

Alt. 1) Utilising the existing measurement mechanism

Alt. 2) A brand new mechanism.

In Alt. 1 the existing measurement configuration and reporting mechanism for e.g., ANR and SI acquisition for HO where UE acquires MIB (and SIB), is utilized. The eNB may configure UE to report SFN/subframe by reusing the existing measurement reporting mechanisms with additional enhancements (e.g., periodic measurement and appropriate trigger purpose). Please note that details on necessary setting in RRC level and the associated UE behaviour will be discussed in the following question.

In Alt2, a brand new framework for SFN/subframe reporting is defined. However the necessity to define new frame is somewhat unclear, especially if the existing mechanism (with some enhancements) can be reused.

Regarding Alt2, the large spec impact is assumed e.g., critical extension. Therefore, the rapporteur tends to consider Alt1 can be a baseline unless significant benefit is identified for Alt2. .

Q2: Wrt. the SFN/subframe offset reporting design, is it agreeable to progress with Alt1 approach? If it is not agreeable, companies are invited to describe the new mechanism they have in mind and to elaborate the gain of creating new mechanism.

Company	Yes/No	Remarks
NEC	Yes/No	From specification impact point of view, we tend to agree with Rapporteur that it is better to reuse the existing mechanism. However, it is not yet clear whether Alt. 1) is simpler from UE point of view. For instance, if ANR mechanism is reused, the UE may be required to acquire SIB1 unnecessarily. Regarding Alt. 2), one potential way is to let the UE monitor the DL signalling on both PCell and PSCell with dual receiver, which is basic assumption for DC capable UE (as described in 36.300, 4.9.1), and measure e.g. Subframe boundary offset. Further discussions are necessary in the meeting.
CATT	Yes	To avoid more standardization works, Alt.1 is simpler to utilize existing mechanism.
Nokia	Yes	
ETRI	Yes	We agree with rapporteur's view to avoid unnecessary specification impact.
ITRI	Yes	
ZTE	Yes	
Intel	Yes	It should be noted that some modifications are needed for Alt1 (e.g. for Q2a, most companies prefer not to acquire SIB1).
Alcatel-Lucent/ Alcatel-Lucent Shanghai Bell	Yes	We think Alt 1 provides sufficient signalling extension which would required for SFN/Subframe offset signalling.
Ericsson		It is not clear what "A brand new mechanism" is so it is hard to answer this question. Also it is not clear which "existing measurement mechanism" is referring to. But in general it would be good to reuse existing mechanisms if it is possible/suitable.
MediaTek	Yes	Not sure why to related offset report to ANR. Although the first offset report can be right after DC configuration, as mentioned that offset can change with UE mobility, so additional report is required. We think current measurement framework, e.g. the periodic reporting and event trigger reporting, can be re-used. Just the contents of reporting and some constraints for reporting could be modified/enhanced.

LG	Yes	
Qualcomm Incorporated	No	The MeNB should not be required to ask the UE to measure the time difference every time DC is configured. At the same time, the standard shall address the time drift between MeNB and SeNB. The MeNB should be made aware that the time difference as observed by the UE changes from what the MeNB assumes or what the UE has reported..
Samsung	Yes	
Huawei, HiSlicon		It is better to reuse existing message if possible. But we should look the details first.
NTT DOCOMO	Yes	

Assuming that Alt1 (utilising the existing measurement configuration and reporting mechanism) is agreeable, existing periodical measurement with trigger purpose of e.g., *reportCGI* may be used. The UE behaviour today when configured with such configuration is to read both MIB and SIB1 of the concerning cell. On the other hand, for calculating SFN/subframe offset between PCell and PSCell, acquiring MIB contents of PSCell is sufficient. Then, it is necessary to clarify whether the UE needs to acquire SIB1 as well as MIB when the existing mechanism is adopted.

Q2a: Is the UE required to read SIB1 as well as MIB if the SFN/subframe offset reporting is introduced by extending the existing measurement configuration and reporting mechanism?

Company	Yes/No	Remarks
NEC	No	We guess this is the question for Case 1. Then, SIB1 is not necessary for SFN/subframe offset reporting.
CATT	No	SIB1 is not necessary and this is also aligned with current RAN4 assumptions.
Nokia	No	For CSG, *the UE performs SI acquisition using autonomous gaps, i.e., the UE may suspend reception and transmission with the source eNB within the limits defined in [TS 36.133] to acquire the relevant system information from the target HeNB.* Reading MIB only should allow the gaps to be shorter.
ETRI	No	MIB is only needed for SFN/subframe offset reporting.
ITRI	No	UE is not required to read SIB1.
ZTE	No	Only MIB is required, but autonomous gap for MIB reading should be sufficient.
Intel	No	UE is not required to read SIB1. In Rel-12, DC UE is not required to read SIB1 of PSCell.
Alcatel-Lucent/ Alcatel-Lucent Shanghai Bell		We think this is related to if only the UE capable of DC is requested for SFN/subframe offset reporting or not. Also whether the UE is DC configured or not. We think these points should first be discussed and agreed before going into detail.
Ericsson	No	To obtain SFN it is sufficient to acquire MIB.
MediaTEk	No	Reading MIB is sufficient to get SFN/subframe index.
LG	No	
Samsung	No	