­3GPP TSG-RAN WG2 Meeting #109-e R2-200xxxx

Electronic Meeting, 24th February – 6th March 2020

Agenda: 6.10.3

Source: Ericsson

Title: Report on offline discussion [AT109e][045][DCCA] Early measurement reporting

Document for: Discussion, Decision

# 1 Introduction

This is a summary of the following offline discussion:

* [AT109e][045][DCCA] Early Measurements Reporting (Ericsson)

Scope: Treat Email discussion + Summary

Part 1:

Intended outcome: Easy agreements, first round of comments for discussive topics, identify/confirm items for postponement. Report current status at Web Conf

**Deadline: Feb 26 (Web Conf)**

Part 2, Continuation:

Intended outcome: Report, Agreed Issues resolutions

**Deadline: Mar 3 1200 CET**

In [21], a summary of the contribution in AI 6.10.3 regarding early measurements was provided. In this offline discussion, a merge has been made with the summary of the email discussion on early measurements [1], so that it will be sufficient to have all the discussions regarding early measurements in one place. Companies are provided with a possibility to confirm regarding the proposals that are anticipated to be easily agreed. For proposals that are expected to need further discussion, companies can provide comments regarding the proposals

1st Deadline: Feb 26, before the DCCA session:

* identified all the easily agreeable proposals
* companies have provided input regarding the other proposals

# 2 Discussion

## 2.1 Recap of Proposals from early measurement email discussion

The following proposals are from the email discussion [1], where there has been a consensus or where the rapporteur believes can be easily agreed (**in brackets are the proposal # used in that email discussion, to be removed in the final version of this summary**), and thus proposed here for easy agreement:

1. (*Proposal 1)* The UE starts to perform early measurements only when it is configured with measIdleDuration in RRC(Connection)Release (i.e. early measurement cannot be started only based on SIB signalling).
2. (*Proposal 2*) RAN2 to confirm that the different ways of configuring early measurements are:
3. All configuration received in dedicated signalling (i.e. RRC(Connection)Release; or
4. All configuration received in broadcast (except for the measIdleDuration); or
5. The dedicated signalling contains measIdleDuration and the list of the EUTRA/NR carriers:
   1. For E-UTRA carriers, the measurement configuration is also contained via the dedicated signaling
   2. For each of the NR carriers, the SSB configuration can be configured either via dedicated signalling or via SIB.
6. (*Proposal 3*) RAN2 to confirm that the NR/EUTRA carrier list can not be split into SIB and dedicated signalling (i.e. either both in SIB or both in dedicated).
7. (*Proposal 4*) The measIdleDuration range in LTE euCA to be adopted in NR (i.e. ENUMERATED {sec10, sec30, sec60, sec120, sec180, sec240, sec300, spare})
8. (*Proposal 5*) As in LTE euCA, the RSRQ-Range-r13 IE (i.e. -30..64) will be used for specifying the thresholds for early measurement reporting of E-UTRA carriers in NR.
9. (*Proposal 6*) ASN.1 signaling to allow the configuration of up to 8 E-UTRA and 8 NR carries for early measurements.
10. (*Proposal 7*) ASN.1 signaling to allow up to 8 E-UTRA and 8 NR carries in early measurement reports.
11. (*Proposal 8*) Measurements of up to 32 beams can be included in the early measurement report of NR carriers.
12. (*Proposal 9*) The *SCS* IE to be on the top level of the MeasIdleCarrierNR (i.e. not within the ssb-MeasConfig IE).
13. (*Proposal 12*) A NOTE to be added in 36/38.331 clarifying that the UE should consider early measurements available only if it has measurement results other than the serving cell.
14. (*Proposal 14*) The UE shall include an early measurement result concerning a certain carrier only if that particular measurement is valid according to RAN4 measurement validity requirement.
15. (*Proposal 16*) Clarification to be added in 36.331 that the UE will be configured with only one validity area (either the rel-15 or rel-16 version)

**Question 1: Do companies agree that the above proposals from the email discussion [1] can be easily agreed? If not, please explain why.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Agree | One minor comment on Proposal 5, the value range of RSRQ-Range-r13 is (-30..46).  RSRQ-Range-r13 ::= INTEGER(-30..46) |
| Qualcomm | Disagree for some of them | * Proposal 6: we think that the current proposal (Opt2) is NOT majority view:   + Opt1: up to 8 NR/LTE combined LTE/NR carriers (8 companies: Nokia, OPPO, MediaTek, Vodafone, Qualcomm, NEC, CATT, Samsung).   + Opt2: 8+8 (only 3 companies: ZTE, Huawei, LG)   Since this proposal has UE impacts, we don’t  think it is good way to directly agree how ASN.1  works. At least, we should first ask RAN4 for their  inputs   * Proposal 7: it is coupled with proposal 6. So, we think it is better to postpone this discussion until it is clear what is max number of NR and LTE frequenies to measure * Proposal 11: it is still not clear what is “RAN4 requirement measurement validity requirement“. And we think this seems to a common understanding, and there is no RAN2 spec impact. So, it is not clear to us why we need this agreement? |
| Mediatek | Agree with comment | On proposal 11, we tend to agree with QC that „*RAN4 measurement validity requirement*“ is unclear. Maybe we should say „*measurement accuracy requirement*“. We are fine to capture nothing, as it is common understanding that UE follows both RAN2 and RAN4 specification. |
| Nokia | Agree |  |
| LG | Agree and further comment | We may need further clarification on Proposal 2-c)-II, if SSB configuration is provided via SIB:  If only timer is configured in *RRCRelease*, the UE will acquire the early measurement configuration via SIB. In this case, how can the UE acquire the frequency list, SIB4 or new SIB? If the new SIB includes both camping and non-camping frequencies, then the UE only needs to acquire new SIB. If not, the UE perform early measurements on all the frequencies in new SIB and SIB4? |
| Intel | Agree with comments | Prop-11 same view as Qualcomm, there is no RAN2 impact, so we do not see the need to discuss this. |
| Samsung | Agree | Related to QC comment for proposal 6: we think proposal is mainly about what ASN.1 signalling allows. The overall limitation is seperate/ additional to that (and indeed more upto RAN4)  Suggest to also add to proposal 8 that this is also about what ASN.1 signalling will support |
| NEC | Agree with comment | On proposal 6, agree with Qualcomm. We understand this is from ASN.1 signaling but limitation is seprate issue on top of this as Samsung comments. |
| Spreadtrum | Agree |  |
| CATT | Agree |  |

The rest of the proposals from the email discussion (except proposal 10 regarding whether to check SCG CA) were to have further discussion in the meeting.

*Proposal 10 In LTE/NR rel-16, for inter-RAT carriers configured for early measurement, the UE performs measurement on that carrier only if it is capable of DC between the concerned carrier and the serving carrier.*

*Proposal 11 RAN2 to discuss whether to support the granular reporting of E-UTRA and/or NR early measurement results, considering the specification impact.*

*Proposal 13 RAN2 to discuss whether to support the exchange of the UE’s early measurement configuration during UE context retrieval, taking specification impact into consideration.*

*Proposal 15 RAN2 to discuss if the UE should include the early measurement results concerning a given carrier only if the UE is capable of performing CA/DC with that particular carrier and the current serving cell’s frequency.*

*Proposal 17 The nrofSS-BlocksToAverage-r16 and absThreshSS-BlocksConsolidation-r16 IEs to be on the top level of the MeasIdleCarrierNR (i.e. not within the ssb-MeasConfig IE).*

There was no contribution regarding proposal 15 and thus that proposal will be kept as is in this document. Regarding proposal 10, two contributions were submitted, so it is further discussed below, along with issues concerning proposals 11 (granular reporting), 13 (UE context handling) and others that were raised in the submitted contributions for this meeting.

## 2.2 Issues discussed based on submitted contributions

***Issue #1: Checking of CA/DC capability with serving frequency***

In [7], [8] and [11], the issue of which of the configured inter-RAT carriers the UE should measure are discussed, specifically whether the UE should also measure on a certain carrier (even if it is not capable of supporting DC between that carrier and the serving carrier) if it is capable of CA (for the SCG) on that carrier and any other inter-RAT carrier being measured that can be configured in DC mode with the serving frequency.

There is indeed a merit in the proposals in [8] (check for SCG CA) and [11] (not check for either CA or DC, if carrier list was received via dedicated signaling) in that not doing so (i.e. just checking for DC) may result in poorer performance (e.g. unnecessary UE measurements or UE not having a measurement on a certain carrier for setting up EN-DC). This topic was discussed in the email discussion and the majority view was to just check for DC, and therein it was proposed (proposal 10) for the UE to check for DC capability between the serving carrier and the frequency being measured (the same as the proposal in [7]). However, the discussion in [11] provides example deployment scenarios where such behavior may not be beneficial for the case where the carrier list is provided via dedicated signaling. Also, it could be argued that when the carrier list is provided via dedicated signaling, the network will take the UE capability into consideration and those are relevant at least until cell re-selection to another frequency.

Thus, the rapporteur proposes to keep the proposal 10 of the email discussion summary for at least the case where the carrier list is provided via broadcast signaling and further discuss the behavior for the case of dedicated signaling.

Easy agreement:

1. In LTE/NR rel-16, if the carrier list for early measurement is provided via broadcast signaling, the UE performs measurement on a carrier only if it is capable of CA or DC between the concerned carrier and the serving carrier.

**Question 2: Do companies agree that the above proposal can easily be agreed? If not, please explain why.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Agree |  |
| Qualcomm | Agree | We think that SCG CA is target for a corner case with marginal benefit but at cost of more UE power consumption:   * UE may be forced to measure more frequencies, which even NW can’t ensure whether useful for them, esepcailly for inter-operator case * The SCG CA requires MN to send early measurements to SN for SN to prepare SCG configuration, which seems to become the dorminent factor of fast EN-DC setup, instead of latency in measurements. |
| MediaTek | Agree |  |
| Nokia | Agree |  |
| LG | Agree | We agree to keep BC comparison between concerned carrier and the serving carrier. |
| Intel | Agree |  |
| Samsung | Agree |  |
| NEC | Agree |  |
| Spreadtrum | Agree |  |
| CATT | Agree | Even though, we see some benefit to considere SCG CA for some cases (e.g. The network wants to configure more SCells on NR for EN-DC for the UE. Then it may be benefit for the UE to report more carriers on NR), we could agree with the proposal for Rel-16. |

Needs discussion:

**Question 3: Which of the following UE behaviours to apply when a carrier list is provided via dedicated signalling:**

**a) Extend proposal 13 also for that case (i.e. UE checks if it is capable of CA or DC between the concerned carrier and the serving carrier)**

**b) Do not check CA/DC capability (as proposed in [11])**

**c) Other (if so, please explain)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred option** | **Comments** |
| ZTE | a) | Although measured frequency list is configured via dedicated signalling, considering the UE is moving and may perform inter-freq cell re-selection. It is possible the network may provide a wider range of frequencies to UE, and assume UE can further iltert he target measured frequencies based on DC/CA relation with camping frequency.  If special treatment is desired (as described in [11]), it should be done by other method (per freq indication), not by mandating all frequencies delivered via dedicated signalling.  But we think special treatment is kind of optimization, that can be considered in Rel-17. |
| Qualcomm | a) | To be honest, we don’t see the difference from broadcast signalling. |
| MediaTek | a) | As we indicated in the e-mail discussion, option a) is already current agreement back to RAN2#106 --  **The UE performs the idle measurement for the frequencies in configured frequency list only when the UE support CA or MR-DC between the frequency and the serving frequency**  We do not find clear motivation to change it. The proposal in [11] seems like a further enhancement for the case that once the UE going to CONNECTED and it has to perform inter-cell handover immediately to get EN-DC. In addition, the proposal change the principle from LTE euCA. We prefer to align with LTE euCA on this basic design.  We would suggest to finalize the details instead of re-opening the discussion on previous agreement. |
| Nokia | a) |  |
| LG | a) | We prefer to keep same condition. It would occur too much power consumption if the UE needs to measure even not CA/DC-capable carrier(s). |
| Intel | a) | There should be no difference |
| Samsung | a) seems fine | (although we are not a bit supporter of limiting to carriers for which CA/ DC is supported but prefer to close the issue)  Note that the TEI16 proposal concerning alternative reselection priorities may address issues like raised in [11] |
| NEC | a) |  |
| Spreadtrum | a) |  |
| CATT |  | We prefer to have same behaviours despite the UE receives the carrier list for early measurement via dedicated signalling or broadcast. |

***Issue #2: Resume procedure (UE context handling, 2-step resume)***

In [4], [5] and [14], the issue of early measurement configuration and UE context are discussed.

In [4] and [5], the scenario where a 2-step resume without context fetch is discussed and it is proposed that the target can include the early measurement configuration in the RETRIEVE UE CONTEXT REQUEST message. This requires RAN3 changes (hence the LS to RAN3 in [5]) and is not really required as it can be solved via network implementation (as the 2-step without context fetch is not a mandatory procedure). Also, the target, not knowing the UE context is not aware whether the UE is capable of early measurements or not.

Easy agreement:

1. No special handling will be specified for the case of 2-step resume without context fetch (i.e. can be handled via network implementation)

**Question 4: Do companies agree that the above proposal can be easily agreed? If not, please explain why.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Agree | Similar view with the Rapporteur, the target should not include new early measurement configuration in the RETRIEVE UE CONTEXT REQUEST message, because it does not know UE’s capability.  If the source node wants to reconfigure it, it can include new configuration in RRC Release message and transmit it to the target node. Or the source responses a RETRIEVE UE CONTEXT RESPONSE message to trigger context relocation, then the target includes new configuration in RRC release message to UE (2-step resume with context fetch). But this can be up to network implementation.  In addition, the early measurement configuration should be valid within a group of cells, so reconfiguration may not happen frequently in this scenario. |
| Qualcomm | Agree |  |
| MediaTek | Agree |  |
| Nokia | Agree |  |
| LG | Agree | We agree to do this without special handling. |
| Intel | Agree |  |
| Samsung | Agree |  |
| NEC | Agree |  |
| Spreadtrum | Agree |  |
| CATT | Agree |  |

In [14], the specification impact to make the target know about the UE’s early measurement configuration during context retrieval is discussed and it is shown that the only change required is the inclusion of the *measIdleConfig* in the *AS-Config* IE, which is part of the *HandoverPreparationInfo* inter-node message. This clarifies the main concern raised during the email discussion about this, which was the anticipated specification impact (also possible RAN3 changes), are not valid.

Needs discussion:

**Question 5: Do companies agree that, in both LTE/NR, including the *measIdleConfig* in the *AS-Config* (of *HandoverPreparationInfo*) is sufficient to enable the target to become aware of the UE’s early measurement configuration during connection resumption? If not, please explain why.**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Disagree | As indicated in email discussion, this causes complexity without clear/certain benefit. |
| Qualcomm | Agree | We think at least in following case, the blind grant can be avoided:   * All the configured frequency list for early measurement is not the new serving cell’s interest. Then the new serving doesn’t need to request UE to report in msg4, correspondingly no UL grant is allocated.   And the spec impact is minor. Thus support |
| MediaTek | No strong view | Considering that this a little bit controversial during the discussion. A suggested way forward maybe just exchange single bit indication on whether the early measurement is configured or not. Exchange the full *measIdleConfig* configuration seems not necessary. |
| Nokia | Disagree | agree with ZTE |
| LG | Agree | We think this is needed to avoid blind request and spec impact is not critical. |
| Intel | No strong view |  |
| Samsung | Disagree | As indicated by ZTE, we don’t see the real need to enhance |
| NEC | Disagree | same view as ZTE |
| Spreadtrum | Disagree | Agree with ZTE |
| CATT | Agree |  |

If companies agree to the above, then it is proposed:

1. In LTE/NR rel-16, the *measIdleConfig* is included in the *AS-Config* IE to enable early measurement configuration available during UE context retrieval.

In [19], it is observed that the network may not be aware if the timer T331 is still running when a 2-step resume is performed (e.g. UE go out of the validity area, stops T311, then goes back again to the validity area, all within the duration of the T311 value). And it is proposed to trigger an RNA update, whenever the UE goes out of the validity area. It is correct that such a mismatch can happen, and the network can never be sure if the UE has the T331 still running or not if a 2-step resume is performed before the actual duration of T331 has passed. The only impact of this is that the network may assume the T331 is running while it is not and respond with a release message the contains no idle measurement configuration.

During discussions regarding the validity area in earlier meetings, whether to restart or continue T331 when the UE goes out of the validity area and then back again was discussed, and it was agreed not to do that as this will not be a very likely scenario. In line with that agreement, the rapporteur’s understanding is that the issue raised in [19] is not a major problem and if the network really wants to ensure the early measurements continues after a 2-step resume, it can include the early measurement configuration in the release message to restart the timer. Also, it should be noted that RAN area and validity area are completely unrelated.

Easy agreement:

1. RNA update is not triggered due to going out of the validity area.

**Question 6: Do companies agree that going out of the validity area does not trigger RNA update? If not, please explain why**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Agree |  |
| Qualcomm | Agree | Firstly, we don’t think it makes sense to change important rocedure (RNA update) just because of validity area. We are not even sure whether validity area will be deployed.  Secondly, this issue raised by Samsung can be totally resolved by Proposal 15 (i.e. measIdleConfig is included in the AS-Config IE to enable early measurement configuration available during UE context retrieval). That is another reason why we support proposal 15. |
| MediaTek | Agree |  |
| Nokia | Agree |  |
| LG | Agree | If UE resumes out of validity area, the network knows the fact if proposal 15 is agreed. So we don’t need special handling for this.  If UE leaves and enters back to the validity area, and then resumes before T331 expiry (UE has stopped the timer but the network does not know it), the network may not know the fact. However, even if the network provides only timer value during 2-step resume, the UE will acquire the carrier frequency information via system information where the intention of the network would be to reuse the previous dedicated configuration. However, this is not a major problem as rapporteur commented. |
| Intel | Agree | We do not intend to bring in additional complexity. |
| Samsung | Disagree | We think this is an easy way to resolve mismatch with marginal spec impact. Regarding Qualcomm’s comment, the configuration mismatch is still there if the UE leaves and comes back to the validity area even P15 is agreed as NW doesn’t know such UE-controlled mobility. |
| NEC | Agree |  |
| Spreadtrum | Agree | No need to modify the RNA procedure just because of the validity area. |
| CATT | Agree |  |

***Issue #3: SIB/dedicated indicators for granular reporting/request/availability/measurement***

The issue of the granular reporting/request/availability indication was addressed in the email discussion [1], and it was proposed to discuss it further, considering the specification impacts.

***LTE:***

In [4], it is proposed that only when the *upperLayerIndication* is set true in the LTE cell, the UE performs the NR frequency measurement according to idle measurement configuration. However, the rapporteur’s understanding is that the *upperLayerIndication* is not to be used for RAN related procedure. Also, there is no need to use this indicator since we have already agreed to have an indicator in SIB2 regarding NR early measurements.

In [10], it is proposed to revert the agreement regarding the new indicator in SIB2 related to NR early measurement results. The reason mentioned there to not have the new indicator in SIB2 is not very clear (“Network may initiate retrieval but will not receive results it cannot use”).

In [12], it is proposed that the UE can indicate availability of early measurement whether it has E-UTRAN and/or NR results (i.e. no granular availability indication). The motivation behind this proposal was simplicity.

In [20], it is proposed that the UE is required to perform E-UTRA measurements if SIB2 contains the *idleModeMeasurements-r15* and UE is required to perform NR measurements if SIB2 contains the *idleModeMeasurements-r16.* The rapporteur’s understanding is that these proposals are in line with the agreements regarding the new indicator definition (i.e. no need to broadcast -r16 indicator if the network does not want the UE to perform NR measurements).

Easy agreements:

1. In LTE rel-16, UE is not required to perform early measurements of E-UTRA carriers if *idleModeMeasurements-r15* is not included in SIB2.
2. In LTE rel-16, UE is not required to perform early measurements of NR carries if *idleModeMeasurements-r16* is not included in SIB2.

**Question 7: Do companies agree that, for early measurements while camping in LTE rel-16, the UE is not required to measure E-UTRA or NR carriers, depending on the inclusion of *idleModeMeasurements-r15* or *idleModeMeasurements-16* IEs in SIB2, respectively? If not, please explain why**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Agree |  |
| Qualcomm | Agree | We can see benefit of reducing UE nnecessary power consumption if the target cell doesn’t support EN-DC or NE-DC. Thus it is acceptable to us. |
| MediaTek | Agree |  |
| Nokia | Agree | In RAN2#108 we agreed:   * A new indication is introduced in SIB2 to indicate that the UE can perform NR early measurements while camped on the cell.   So we have a r15 indication (LTE) and r16 indication (NR) already based on agreements from RAN2#108  But we would rephrase proposal to more “positive” approach:  **for early measurements while camping in LTE rel-16, the UE is required to measure E-UTRA or NR carriers, depending on the inclusion of *idleModeMeasurements-r15* or *idleModeMeasurements-16* IEs in SIB2, respectively**  **Not critical to update proposal.** |
| LG | Disagree | We think it is not needed to filter the UE’s measurement by SIB. As early measurement results are accumulated until reporting, even if the current serving cell broadcasts only NR frequencies to measure, the UE may have LTE measurement results from previous serving cell – the UE will indicate availability of both LTE and NR.  Regarding the case that the target cell doesn’t support EN-DC or NE-DC, if those kind of cell exists in the neighbour cells, the source cell should provide SIB-based early measurement configuration (i.e. provide only timer value in *RRCRelease*).  Regarding the agreement made in RAN2#108 which Nokia mentioned, my understanding is that the new indication is introduced in NR, not additional R16 indication in LTE. We could clarify this. |
| Intel | Agree | As already agreed in earlier meeting. |
| Samsung | No real need | We acknowledge there was an earlier agreement, but note that it was not correctly reflected in the Running CR. Furthermore, there subsequently seemed a large majority to avoid introducing fine granularity.  We think that *ssb-MeasConfig* is typically provided on broadcast and note that if so, UE does not measure concerned frequency if serving cell does not provide this. So, we think that in practice, it seems fine to use a common bit alike in NR  If majority prefers to keep the separate indication, we think that name should change to reflect they control availability reporting for LTE and NR (while UE is only required to measure if set) i.e. aligned with how this is specified in NR |
| NEC | Agree | we thought these were already as baseline.  Agree with Nokia. |
| Spreadtrum | Agree | As agreed that we need separate indications for R15 and R16 in LTE. |
| CATT | No strong view |  |

In [15], it is proposed to have granular availability indication where the *idleModeAvailable-r16* (of type ENUMERATED {eutra, nr, both})is introduced in *RRCConnectionResumeComplete* and *RRCConnectionSetupComplete* messages. Additionally, it is also proposed to have granular request/reporting by defining the *idleModeMeasurementReq-r16* in *RRCConnectionResume* message to be of type ENUMERATED {eutra, nr, both}, and introducing a similar indicator in *UEInformationRequest*.

In [20], it is proposed that, instead of using separate availability indicators in *RRCConnectionResumeComplete* or *RRCConnectionSetupComplete,* the UE will make use of the SIB2 indicator to decide whether to indicate availability or not. That is, UE will indicate it has available measurements if it has E-UTRA results and *idleModeMeasurements-r15* is included OR if it has NR results and *idleModeMeasurements-r16* is included. Similarly, it is proposed for the measurement reporting that the UE includes the E-UTRA results only if SIB2 contains *idleModeMeasurements-r15* and NR results only if SIB2 contains *idleModeMeasurements-r16.*

The proposal in [20] is simpler than in [15] as it requires less specification changes. However, making the SIB affect also the availability indication and request/reporting will not lead to UE specific control, will not support per-RAT availability indication, and if different behaviour is desired, SIB update is required (for example, network may not be interested in NR measurements, e.g. due to load conditions on neighbouring NR cells). Even though the proposal in [20] will lead to less specification changes, it is possible to capture granular availability/request of early measurements in 36.331 proposed in [15] with minor specification impact (as can be seen in the accompanying TPs in [15]). This also addresses one of the main concerns raised against having granular request/availability indication during the email discussion [1], which was the anticipated specification impact.

Thus, it is proposed:

Possible agreements:

1. In LTE rel-16, granular availability indication of early measurement results (EUTRA, NR or both) is supported (via *RRCConnectionResumeComplete* and *RRCConnectionSetupComplete*).
2. In LTE rel-16, granular request of early measurement results (EUTRA, NR or both) is supported (via *RRCConnectionResume* and *UEInformationRequest)*

**Question 8: Do companies agree to support the UE to indicate that it has early measurement results related to EUTRA, NR or both in the RRCConnectionResumeComplete/ RRCConnectionSetupComplete messages? If not, please explain why**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Agree |  |
| Qualcomm | Disagree | We think that the existing mechanism (i.e. the UE reports all available early measurement same as Rel-15 euCA) is enough. Furthermore, if we have agreed Proposal 17/18, we think these two proposals are non-critical optimizations with marginal benefit:   * **Non-critical:** Rel-16 early measurement could work well without these 2 proposals (i.e. the UE reports all available early measurement same as Rel-15 euCA). We are nore sure why we needs to purse these non-critical optimization at this stage. * **Marginal benefit:** If we agree P17/18, then P19/20 can’t save UE power consumption but just reduce reporting overhead. We doubt how much overhead can be achieved. Furthermore, the granular availability/request may not be useful in some cases: e.g. the UE may have stopped NR early measurements when *idleModeMeasurements-r16* is absent in SIB2. Then, we are not sure how granular availability/request can help. * **Increased UE efforts:** if we agree P17/P18, the UE needs extra efforts to check the per-RAT availbilty and filter the early measurements in same RAT. We think that it is better for NW to do it because NW will anyway need to filter its useful measurements (e.g. concerned frequencies) from UE’s reporting. We are not sure how much processing reduction the NW can achieve in reporting granular of just per-RAT.   Finally, if the grant for early measurement is the concern, we think this question is related to final decision on P6/P7. If we have to specify this, we would like to first see a solid analysis on how much benefit of overhead can be achieved based on agreed max frequency nunber. |
| MediaTek | Agree | But thinking that this is controversial |
| Nokia | disagree | agree with QC and their argumentation |
| LG | Agree | The purpose of early measurements is to achieve fast CA/DC setup with more power consumption. From this point of view, rather than Proposal 17/18, Proposal 19/20 are beneficial that the UE performs early measurements on the configured frequencies but reports only required parts by the network. |
| Intel | Disagree | This is an optimization that is not absolutely necessary |
| Samsung | Disagree | See our remark to Q7 |
| NEC | Disagree | we also think this is non-essential optimization. |
| Spreadtrum | Disagree | Not necessary to keep the UE from reporting the measurement results it already has. |
| CATT | No strong view |  |

**Question 9: Do companies agree to support the network to request the UE to send early measurement results related to EUTRA, NR or both in the RRCConnectionResume/UEInformationRequest messages? If not, please explain why.**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Agree |  |
| Qualcomm | Disagree | See our comments in Question 8. We think that the existing mechanism (i.e. the UE reports all available early measurement same as Rel-15 euCA) is enough. And granular availability/request are non-critical optimizations with marginal benefit. |
| MediaTek | Agree | But thinking that this is controversial |
| Nokia | disagree | agree with QC and their argumentation |
| LG | Agree | Similar comment with Question 8. If UE performs early measurements on LTE carriers in the current serving cell but measured on NR carriers in the previous serving cell, and the UE reports availability regardless of RAT – still unnecessary reporting exists even if RAN4 requirement is considered.  Therefore, our understanding is that if P17/18 is adopted, P19/20 also needs to be adopted. However, we don’t think measurement RAT filtering by SIB indication is not beneficial – only prefer P19/20. In other words, the UE performs early measurement on the configured frequencies based on its BC capability, and the report is based on the network’s RAT-preference. |
| Intel | Disagree | Not critical |
| Samsung | Disagree | See our remark to Q7 |
| NEC | Disagree | aligned with comment to Q8 |
| Spreadtrum | Disagree | Not needed. |
| CATT | No strong view |  |

***NR:***

In [12], it is stated that granular measurement request in NR is not needed but no specific argument was provided.

In [9], it was proposed to have the *idleModeMeasurements* indicator in SIB1 to be defined as type ENUMERATED {eutra, nr, both}, which determines whether the UE performs early measurements on E-UTRA carriers, NR carriers, or both.

In [20], it is proposed to have two indicators in NR SIB1, one related to E-UTRA measurements, and another one related to NR measurements and align the behaviour to the ones proposed for LTE (proposals 7 and 8).

The principle behind the proposals in [9] and [20] are the same, the only difference being whether to have one IE that can take several values ([9]) vs. separate IEs ([20]). That can be left to the discussion on the running CR and it is proposed to agree on the main principle:

Easy agreement:

1. In NR rel-16, the *idleModeMeasurements* can be used to specify whether the UE is required to perform early measurements on EUTRA, NR or both carriers. FFS if one IE (i.e. ENUMERATED {eutra, nr, both} or separate IEs (i.e. one for EUTRA, one for NR) is to be used.

**Question 10: Do companies agree that, for early measurements while camping in NR, the UE is not required to measure E-UTRA or/and NR carriers, depending on the value of *idleModeMeasurements* IE(s) in SIB1? If not, please explain why**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Agree |  |
| Qualcomm | Agree | Similar to our comments in Q8, we can see benefit of reducing UE unnecessay power consumption if the target cell doesn’t support EN-DC or NE-DC. Thus it is acceptable to us. If it is agreed, we prefer to align LTE signaling, i.e. separate IEs (one for EUTRA, one for NR) |
| MediaTek | Agree |  |
| Nokia | Agree | Although not really critical we are OK to have two indicators similarly as proposed by Q7 for LTE. This would also align NR/LTE behaviour |
| LG | Disagree | We think 1-bit indication is enough as we did in LTE euCA. |
| Intel | No strong view |  |
| Samsung | Disagree | See our remark to Q7 |
| NEC | Agree |  |
| Spreadtrum | Agree |  |
| CATT | No strong view |  |

In [15] and [20], the same proposals are made as for LTE. Similar to the LTE case, the anticipated specification impact was one of the major concerns raised against granular request/availability indication in NR during the email discussion. However, as can be seen in the accompanying TP in [15], it is possible to capture granular availability/request of early measurements in 38.331 with minor specification impact. Also, the same flexibility of the proposals in [15] as compared to those in [20] discussed for the LTE case (per-RAT availability indication, per-UE control, no need to modify SIBs, etc) also apply for the NR case.

Thus, it is proposed:

Possible agreements:

1. In NR rel-16, granular availability indication of early measurement results (EUTRA, NR or both) is supported (via *RRCResumeComplete* and *RRCSetupComplete*).
2. In NR rel-16, granular request of early measurement results (EUTRA, NR or both) is supported (via *RRCResume* and *UEInformationRequest).*

**Question 11: Do companies agree to support the UE to indicate that it has early measurement results related to EUTRA, NR or both in the RRCResumeComplete/ RRCSetupComplete messages? If not, please explain why**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Agree |  |
| Qualcomm | Disagree | See our comments in Question 8. We think that the existing mechanism (i.e. the UE reports all available early measurement same as Rel-15 euCA) is enough. And granular availability/request are non-critical optimizations with marginal benefit. |
| MediaTek | Agree | But thinking that this is controversial |
| Nokia | Disagree | Agree with QC |
| LG | Agree | Please see our comments on Question 8 & 9. |
| Intel | Disagree | Same view as our earlier response on this. |
| Samsung | Disagree | See our remark to Q7 |
| NEC | Disagree | same as Q8 and 9 |
| Spreadtrum | Disagree | See the comments in Q8. |
| CATT | No strong view |  |

**Question 12: Do companies agree to support the network to request the UE to send early measurement results related to EUTRA, NR or both in the RRCResume/UEInformationRequest messages? If not, please explain why.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Agree |  |
| Qualcomm | Disagree | See our comments in Question 8. We think that the existing mechanism (i.e. the UE reports all available early measurement same as Rel-15 euCA) is enough. And granular availability/request are non-critical optimizations with marginal benefit. |
| MediaTek | Agree | But thinking that this is controversial |
| Nokia | Disagree | Agree with QC |
| LG | Agree | Please see our comments on Question 8 & 9. |
| Intel | Disagree |  |
| Samsung | Disagree | See our remark to Q7 |
| NEC | Disagree |  |
| Spreadtrum | Disagree |  |
| CATT | No strong view |  |

***Issue #4: Other aspects***

Here miscellaneous topics not covered above are summarized.

In [1] (question 15, proposal 15), the issue whether the UE should only include the early measurement results concerning a given carrier if the UE is capable of performing CA/DC with that particular carrier and the current serving cell’s frequency (i.e. as in the decision on whether to perform early measurements on a given carrier) was discussed. Though a majority of the companies answered *yes*, it seemed that the question was misunderstood, as most companies have also commented that this is the same as keeping LTE euCA behaviour (LTE euCA does the check only when performing the measurements, not in reporting them).

Needs further discussion:

**Question 13: Do companies agree that the UE, when reporting early measurement results, should include the results concerning a given carrier only if the UE is capable of performing CA/DC with that particular carrier and the current serving frequency? If not, please explain why not**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | No strong view | In our opinion, this is a corner case.  When UE moves to a cell in which previous measured frequency does not fullfilll CA/DC, the UE will stop measuring that frequency, and the old measurement results will be discard by UE latter based on the results validity requirement.  So the problem only happens when UE triggers RRCResume right after cell reselection.  We are ok to do enhancement (do CA/DC check during reporting), and we are also ok if the majority want to align with LTE euCA. |
| Qualcomm | Disagree | Similar to our position to granular availblity / request, we don’t think the UE is required to check anything before reporting, i.e. the UE reports its available early measurements same as Rel-15 euCA. We don’t think it is essential to specify new requirements to prevent the UE from reporting what it already has. |
| MedaiTek | Disagree | If the UE only measure the DC/CA candidates, of course the reporting will only include the corresponding results. Maybe there is some corner case as mentioned by ZTE that there will be mismatched. But we think there is no need to optimize for rare scenario. Follow LTE euCA principle is fine. |
| Nokia | Disagree | We agree with QC – unnecessary complexity without really clear benefits. Separate indications in SIBs is sufficient to limit reporting. Secondly EUCA does not have this complexity. Let’s do the same. |
| LG | Disagree | UE already performs early measurement based on band combination capability, so we do not think it is not required to reconsider it again upon reporting. |
| Intel | Disagree |  |
| Samsung | Disagree | Agree there seems no real need to specify a UE requirement concerning reporting |
| NEC | No strong view | we can agree, while we might misunderstand that the majority support this during email disc [1].. we are OK with majority view here. |
| Spreadtrum | Disagree | Not necessary and it will add complexity. |
| CATT | Disagree | The UE performs early measurement with checking CA/DC capability. Therefore, we don’t think the UE needs to check again when reporting ealry measurement results with less benefit. |

In [3] and [16], it is proposed to have a priority indicator in the early measurement carrier list to cover the case where the number of early measurement frequencies that the UE can measure/report may be less than the number of early measurement frequencies that the UE is configured to measure. This problem is inherited from LTE euCA where the UE can be configured to measure up to 8 carriers but can store/report only 3.

This issue was discussed in the email discussion and the majority view was to have ASN.1 signalling to allow the configuration of up to 8 carriers (for both RATs) to measure and up to 8 carriers (for both RATs) to report. However, the issue will still remain if the network is able to configure more frequencies than the UE can measure at one.

One of the following way forwards can be taken:

1. Network ensures that the UE will not be configured to measure more than it is capable of measuring at once
2. In case network can configure the UE more frequencies to measure than the UE is capable of measuring at once:
   1. Frequency priority provided as proposed in [3] and [16]
   2. It is left up to UE implementation on which frequencies to prioritize

In case of 1 and 2.b, no specification changes are required (except possibly for clarification notes or field descriptions), while 2.a will require some specification changes in early measurement procedures and ASN.1 signalling.

Considering this is a topic that has not been properly discussed so far, the rapporteur’s proposal is to discuss this in subsequent email discussions after 109-e or during 109-bis.

Needs further discussion:

**Question 14: With regard to possible mismatch between the list of carriers that the UE is configured to measure and what it can measure/report, which of the following is preferred:**

1. **Network ensures that the UE will not be configured to measure more than it is capable of measuring at once**
2. **In case network can configure the UE more frequencies to measure than the UE is capable of measuring at once:**
   1. **Frequency priority provided as proposed in [3] and [16]**
   2. **It is left up to UE implementation on which frequencies to prioritize**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred option** | **Comments** |
| ZTE | 2a > 2b  Option 1 is unacceptable to us | For idle measurement configured via SIBx, it is impossible for network to consider per-UE capabiilty. For idle measurement configured via dedicated signalling, as we replied in Q3, conidering the UE is moving, it is possible network may provide more frequencies to UE, but the UE is only required to measure the frequency that forms DC/CA. So option 1 is unacceptable to us.  If RAN4 defines the maximum number of measured frequencies is less than 8 (e.g. 3), it is beneficial for UE to first measure the most NW concerned frequencies. This can be done by configuring explicit priority, or implicit rules (e.g. the order of entries in frequency list). |
| Qualcomm | Postpone the discussion | We can discuss this issue after P6/P7 is finalized. Maybe, it is not an issue anymore by then. |
| MediaTek | Option 1 and 2.b | The NW could ensures that the UE will not be configured to measure more than it is capable of measuring at once. If the configured number of measurement frequencies exceeds UE capability, it is up to UE implementation on which frequencies to measure. Nothing need to be specified in the RAN2 SPEC. We believe this is the same principle as in CONNECTED mode measurement.  Option 2.a is further optimization and we don’t think this is necessary. |
| Nokia | 2b | This is what we do for reselection and definitely it is sufficient for early measurements as well. And this seems to be the case for EUCA as well. |
| LG | Option 2-b | We think that we don’t need to specify this. |
| Intel | 1 and then 2b |  |
| Samsung | 2b | We agree there is no need to specify UE requirements regarding which frequencies to prioritise |
| NEC | 2b |  |
| Spreadtrum | 2b | No need to specify UE’s behaviour. |
| CATT | First preference (option 1)  Second preference (2b) |  |

In [2], the following is proposed:

*(Proposal 3) The parameters frequencyBandList, ssbSubcarrierSpacing, nrofSS-BlocksToAverage-r16 and absThreshSS-BlocksConsolidation-r16 are defined outside the ssb-MeasConfig sturcture.*

During the early measurements email discussion [1], CATT has raised a similar concern about these parameters, and most of this is already captured in proposals 9 and 17 of [1] (except for the case of *frequencyBandList*).

Possible agreement:

1. The *frequencyBandList, nrofSS-BlocksToAverage-r16 and absThreshSS-BlocksConsolidation-r16 IEs to be on the top level of the MeasIdleCarrierNR (i.e. not within the ssb-MeasConfig IE).*

**Question 15: Do companies agree that the *frequencyBandList*, *nrofSS-BlocksToAverage-r16* and *absThreshSS-BlocksConsolidation-r16* IEs to be on the top level of the *MeasIdleCarrierNR* (i.e. not within the ssb-MeasConfig IE). If not, please explain why**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Disagree | If the target measured frequency is configured for both early measurement and cell reselection, the UE must use the same set of cell quality derivation parameters. Otherwise, it requires the UE to maintain two sets of L3 RSRP/RSRQ results for a given target cell (one for early measurement, the other for cell reselection), this will cause much complexity to UE implementation.  So, in case the network provides frequency list by dedicated signalling, and wants UE to obtain ssb-MeasConfig from SIB, the cell quality derivation parameters should also be obtained from SIB, and UE keeps updating upon cell-reselection. |
| Qualcomm | Agree | For ZTE’s concern, our understanding is that just these paramters of non-camping frequencies in new NR SIBX are moved on top of MeasIdleCarrierNR. We will not change these paramters of camping frequencies which are located in NR SIB2/4. |
| MediaTek | Agree on frequencyBandList | For nrofSS-BlocksToAverage-r16 and absThreshSS-BlocksConsolidation-r16, we have similar view as ZTE. |
| Nokia | Disagree | If we understand proposal correctly it would allow such a configuration that UE would have different parameters for reselection and different ones for idle mode measurements. We do not see need for this. |
| LG | Agree on frequencyBandList | We also think only frequencyBandList needs to be on the top level. |
| Samsung | Disagree | Similar veiw as expressed by ZTE |
| NEC | Agree on frequencyBandList |  |
| Spreadtrum | Agree on frequencyBandList | Agreed with ZTE and have the similar concern. |
| CATT | agree |  |

In [2], the scenario where the SSB configuration is provided in dedicated or broadcast signalling is discussed, and it is proposed that the SSB configuration is provided via dedicated signalling for the scenario that the network is synchronous within the whole network or within the validity area. It was also proposed to introduce an indicator in the release message whether the SSB configuration is valid only in the current cell or not. The first proposal is specifying network behaviour and thus not needed. The second one is also not needed because similar UE behaviour can be achieved by not

including the SSB configuration in dedicated signalling and providing it via broadcast.

Easy agreement:

1. No additional information regarding dedicated SSB configuration validity will be specified.

In [13], it is proposed to configure SFTD measurements as part of early measurements performed during IDLE/INACTIVE. The main motivation behind the proposal was to alleviate the need for connected UEs to perform such measurements. However, the SFTD measurements in CONNECTED are already optimized and a UE’s transmission/reception of data is affected only for one subframe before and after the SFTD measurement window (i.e. when the RF receiver that is used for measurement is turned on or off). Also, it is not clear if the SFTD measurements are within the scope this work item. Additionally, this is a major enhancement to be introduced so late in the work item phase without sdetailed discussion.

Easy agreement:

1. In rel-16, SFTD measurements cannot be configured as part of early measurement configuration.

In [17], the handling of early measurement results during inter-RAT reselection is discussed and it is proposed that the UE discards the stored early measurement results of a frequency if the frequency is not included in the early measurement configuration in the system information broadcast by the new inter-RAT cell. In the email discussion [1], the handling of early measurement results was discussed and there was a consensus that early measurement results will be kept/reported by the UE as long as they fulfil the validity requirements to be specified by RAN4. The rapporteur’s understanding is that this applies to any measurement results (i.e. results stored before inter-RAT cell re-selection). Thus, no further enhancement is needed to be considered for handling early measurement results after inter-RAT re-selection.

Easy agreement:

1. No special handling of early measurement results during inter-RAT cell reselection will be specified.

In [18], it is observed that the UE may perform measurements on frequencies that are not relevant for the current serving cell (e.g. network not possible to perform CA/DC between the configured frequency and the serving frequency). Thus, it was proposed to provide per-frequency early measurement target frequency list. The proposal is trying to implicitly provide network capability to the UE by introducing a per(serving) frequency target frequency list. There has been a discussion in earlier meeting that the network does not need to provide assistance information to the UE regarding its capability. Also, similar behaviour can be achieved as proposed therein if the network configures the carrier list to be measured in broadcast instead of dedicated signalling.

Easy agreement:

1. The early measurement configuration will not be enhanced to support per (serving)-frequency early measurement target frequency list.

In [10], it is proposed to add the following two notes to the running CRs:

*Note 1 A UE provided with ssb-MeasConfig by dedicated signalling may reselect a cell employing somewhat different parameter values for the SSB configuration e.g. a different SMTC. As a result, the UE may fail to continue performing early measurements. From such error condition onwards, the UE may abort performing early measurements for the concerned frequency.*

*Note 2 The further details regarding the error conditions upon which the UE is allowed to abort are left to UE implementation.*

The rapporteur’s understanding is that if the network deployment is synchronous, such a situation should not occur (i.e. no mismatch between the dedicated SSB configuration for a carrier in one cell and the broadcasted SSB in another cell). For the case of asynchronous deployment, it could be questioned why the network will communicate the SSB configuration in dedicated. The only scenario of interest to do so seems to be: network decides to use dedicated SSB configuration for a non-overlapping frequency (i.e. not a candidate for cell re-selection in the cell where the UE got released), and configures the SSB configuration for that frequency via Release (even though it was asynch deployment). UE then performs cell re-selection and in the target cell that frequency is an overlapping frequency and thus SSB configuration provided in SIB4 (or SIB24 in the case of LTE). For cell re-selection measurements, UE will use the SIB4/24 configuration, but there could be some confusion on what SMTC value to use for early measurements if the value received in Release was different from the one being broadcasted by the current cell.

This was discussed in earlier meetings, and no specific handling was agreed because many companies argued that this is a corner case. If any specific handling is required, actually the most sensible way is to use the SMTC that is broadcasted in the current cell (why would a UE do not use the SMTC that is working for the cell re-selection measurement). But companies were against this because of the general principle that dedicated signalling should trump over broadcasted signalling.

In general, there are a lot of things assumed that the UE can do that is not captured in the spec. If the network has provided a wrong SMTC value in dedicated (be it for early or connected mode measurements), then UE will try to perform the measurements and may not detect any cells (but nothing prevents a smart UE implementation to try other SMTC values and be able to detect the cells). For the case in hand, nothing prevents the UE to use the SMTC value that is provided for cell re-selection also for early measurements. Thus, the onus is on the network to ensure the UE gets the proper SMTC configuration, and if that is not the case, the network has to accept that the measurements received may not be complete. The specification will be cluttered with NOTES if we want to cover all such cases whenever we discover them.

The rapporteurs’ proposal is thus not to add the proposed notes.

Easy agreement:

1. No additional clarification needed in the RRC specs for the case where there is SMTC mismatch between the dedicated and broadcasted SSB configuration.

**Question 16: Do companies agree that the above proposals (proposals 25 to 29) can be easily agreed? If not, please explain why.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| ZTE | Partially | We are ok with P25~P28.  For P29, considering RAN2 already made the following agreement in RAN2#107bis, we are ok to capture the agreement in specification.  2: No UE requirements will be specified for what UE shall do upon reselection to a cell broadcasting for some frequency an SSB measurement configuration that differs from the values received in the RRC release message i.e. UE may stop early performing measurements for concerned frequency  In our understanding, the main purpose is not to force UE to continue idle measurement on that frequency. Also, the wording “may abort...“ in note does not prevent smart UE to continue measurement (by using SIB configuration) if the UE wants. |
| Qualcomm | Agree P25-28 | For P29, we agree with ZTE to capture the agreement in RAN2#107b. |
| MediaTek | Agree P25~P28 | We have some sympathy on the SMTC proposals in [10]. If however this could not be concluded, we would suggest to postpone the discussion. Anyway, it is very detail specification on whether to capture the NOTE. |
| Nokia | Agree P25-P29 | Regarding P29 – at most NOTE is needed as we do not specify error scenarios in detail in RAN2. Just to clarify we do not disagree with agreement referred by ZTE above. |
| LG |  | Regarding P27, if majority view is that RAN4 requirement would work to handle the measurement results upon inter-RAT cell reselection case, we are okay. |
| Intel | Agree P25-28 | For P29, we agree with ZTE to capture the agreement in RAN2#107b. |
| Samsung | Agree P25-P28 | Regarding P28, we agree that it is relevant to capture the previous agreement (are open for suggestions to improve the wording) |
| NEC | Agree P25-28 | For P29, we are fine to add a NOTE capturing the agreements in #107bis. |
| Spreadtrum | Agree P25-28 | For P29, we should follow the agreement and capture it in the specification. |
|  |  |  |

# 3 Conclusion

According to the contributions submitted regarding this topic and the summary of the email discussion on early measurements, the following proposals are made for agreement:

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