3GPP TSG-RAN WG2 #114-e R2-210xxxx

eMeeting, 19th – 27th May, 2021

Agenda Item: 6.1.4.1.5

Source: MediaTek Inc.

**Title: Report of e-mail discussion [AT114-e][022][NR16] RRC II (MediaTek)**

Document for: Discussion and decision

# 1 Introduction

This is report for the following AT114-e mail discussion.

* [AT114-e][022][NR16] RRC II (MediaTek)

Scope: Treat R2-2105069, R2-2105423, R2-2105425, R2-2105427, R2-2106338, R2-2106339, R2-2106340, R2-2106382, R2-2106383, R2-2104987, R2-2104717, R2-2105713, R2-2105714, R2-2104985, R2-2104986, R2-2105712, R2-2106115, R2-2106116, R2-2106117, R2-2106118, R2-2105645, R2-2105358, R2-2106464

Phase 1, determine agreeable parts, Phase 2, for agreeable parts Work on CRs.

Intended outcome: Report and Agreed CRs.

Deadline: Schedule A

Phase 1 deadline - **Friday May 21 1000 UTC**

# 2 Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| MediaTek (Rapp) | Felix Tsai | chun-fan.tsai@mediatek.com |
| Ericsson | Oscar Ohlsson | oscar.ohlsson@ericsson.com |
| Qualcomm Incorporated | Masato Kitazoe | mkitazoe@qti.qualcomm.com |
| Docomo (MPS Redirection) | Masato Taniguchi | masato.taniguchi.mf@nttdocomo.com |
| Huawei, HiSilicon | Simone Provvedi | simone.provvedi@huawei.com |
| Nokia, Nokia Shanghai Bell | Tero Henttonen | tero.henttonen@nokia.com |
| Samsung | Jaehyuk Jang | jack.jang@samsung.com |
| Intel | Sudeep Palat | Sudeep.k.palat@intel.com |
| Apple | Pavan Nuggehalli | pnuggehalli@apple.com |
| Perspecta Labs | Achilles Kogiantis | akogiantis@perspectalabs.com |
| vivo | Yangxiaodong5g@vivo.com | Yangxiaodong5g@vivo.com |
| CATT | Jing Liang | liangjing@catt.cn |
| ZTE | Yuan Gao | gao.yuan66@zte.com.cn |

# 3 Discussion (Phase 1)

## 3.1 TEI16 - MPS Redirection

In this section, we discuss the MPS redirection issue with the intention to endorse some CRs. The following CRs from Perspecta Labs (and other companies) are almost endorsable in last meeting.

**CR set I**

[R2-2105069](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2105069.zip) Redirection with MPS Indication Perspecta Labs, CISA ECD, T-Mobile US, Ericsson, Qualcomm, NTT DoCoMo, AT&T, Verizon CR Rel-16 36.331 16.4.0 4579 4 C NR\_newRAT-Core, TEI16 R2-2103042

[R2-2105423](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2105423.zip) Redirection with MPS Indication Perspecta Labs, CISA ECD, T-Mobile US, Ericsson, Qualcomm, NTT DoCoMo, AT&T, Verizon CR Rel-16 38.331 16.4.1 2413 4 C NR\_newRAT-Core, TEI16 R2-2104635

[R2-2105425](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2105425.zip) Redirection with MPS Indication Perspecta Labs, CISA ECD, T-Mobile US, Ericsson, Qualcomm, NTT DoCoMo, AT&T, Verizon CR Rel-16 36.306 16.4.0 1804 3 C NR\_newRAT-Core, TEI16 R2-2104636

[R2-2105427](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2105427.zip) Redirection with MPS Indication Perspecta Labs, CISA ECD, T-Mobile US, Ericsson, Qualcomm, NTT DoCoMo, AT&T, Verizon CR Rel-16 38.306 16.4.0 0526 3 C NR\_newRAT-Core, TEI16 R2-2104637

However, there is another set of CR from ZTE that propose slightly different way (a more generic way) to perform this kind of prioritization after redirection.

**CR set II**

[R2-2106339](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2106339.zip) Redirection with high priority access-38.331 ZTE corporation, Sanechips CR Rel-16 38.331 16.4.1 2691 - C NR\_newRAT-Core, TEI16

[R2-2106340](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2106340.zip) Redirection with high priority access-38.306 ZTE corporation, Sanechips CR Rel-16 38.306 16.4.0 0603 - C NR\_newRAT-Core, TEI16

[R2-2106382](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2106382.zip) Redirection with high priority access-36.331 ZTE corporation, Sanechips CR Rel-16 36.331 16.4.0 4685 - C NR\_newRAT-Core, TEI16

[R2-2106383](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2106383.zip) Redirection with high priority access-36.306 ZTE corporation, Sanechips CR Rel-16 36.306 16.4.0 1818 - C NR\_newRAT-Core, TEI16

The rapporteur suggest to discuss the some high level principle (mentioned in discussion paper [R2-2106338](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2106338.zip)) before going to CR details.

[R2-2106338](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2106338.zip) Redirection with high priority access ZTE corporation, Sanechips discussion Rel-16 NR\_newRAT-Core, TEI16

The first question is whether we should use unified solution for high priority redirection.

**Question 1.1: Which approach does company prefer?**

* **Option 1 – Specific enhancement for MPS redirection (CR set I)**
* **Option 2 – A unified mechanism to support redirection with high priority access (CR set II)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Prefer Option** | **Comments** |
| Ericsson | 1 | A generalized approach would have been good but the high services differs slightly which makes it hard to design a general solution that fits all of them. For example, setting the correct establishment cause will be difficult unless the specific service is indicated in the release with redirect. There might also be some differences in how to handle access control. It’s also a bit late now to introduce a general solution since we already introduced a service specific solution for LTE voice fallback. |
| Qualcomm Incorporated | Option 1 (Proponent) | Differences I see in the set II as compared to the set I are:   1. High priority indication only affects ACB, but not the establishment cause. 2. With high priority indication, the UE does not even check ACB for Access Identity 1 (MPS), i.e. it allows full access right regardless of ACB.   The second one especially is a major departure from the existing ACB framework and hence should be avoided. |
| Docomo | Option 1 | From an operator perspective, we need both of the following:   1. skipping access barring in the redirected carrier; and 2. prioritized handling in the redirected carrier or e/gNB.   We support Option 1 as it is a straightforward solution to achieve both of the above requirements. |
| Huawei, HiSilicon | 1 | We do not think we should have any general approach at this stage. The higher priority discussion is case by case as different cases could use different handling. For example, we already have establishment cause for emergency call. We should only agree the cases that have been discussed and reached consensus. We are OK with Option 1 |
| Nokia, Nokia Shanghai Bell | 1 | It's better to go with the endorsed CRs which strictly limit the use case. This kind of *carte blanche* is already somewhat dangerous to normal operation, so it should be kept to the specific use case. |
| Samsung | 1 | We share the view with many others that the case should be limited to the specific use case. |
| Intel | Option 1 | Similar to Ericsson comment, a unified approach would have been nice but seems a bit difficult. |
| Apple | Option 1 | We also think that a unified mechanism brings some benefits are open to extending CR set I to consider other use cases. |
| Perspecta Labs | Option 1 | We support the concept of a unified mechanism. However, we cannot support the specific implementation since it cannot cover the MPS objectives:  1. The establishment cause value is not set and therefore it leaves the redirected UE susceptible to not prioritized processing at the target (redirected) RAN node. This occurs even though on the UE side the barring check is passed.  As pointed by other companies, a general framework may have corner cases that could be problematic and should therefore be studied first. |
| CATT | Option 1 | Considering the requirement to having a unified mechanism is not clear enough, we prefer to discuss specific enhancement for MPS redirection at first. |
| ZTE | Option 2 (Proponent) | * As observed in our paper, prioritized access at the target cell after release with redirection may also be needed in some other cases, e.g. redirection for slice with low latency requirement, redirection for emergency call, redirection for other high priority access identities (AI 11-15) in addition to the MPS. * For the two operations proposed in option 1: * Operation 1: Ignore the UAC configuration for Access Identity 1 * Operation 2: Set the establishment cause to mps-PriorityAccess   We understand it is a best effort solution with both operation 1 and operation 2 and successful access is still not ensured as it is up to NW to decide whether to accept or not.  And CT1 involvement is foreseen if it is aimed to allow AS layer to ignore the establishment cause provided by upper layer and set one by itself while allowing UE to ignore the UAC configuration is totally within RAN2 working scope without impact on other TSG, which is possible to be agreed in RAN2 as TEI.   * With the above consideration, it is proposed to apply operation 1 only and make it a unified mechanism workable for all the prioritized access. |
| vivo | Option1 | Agree with the above companies’ comments |

Another difference between CR set I and set II is on handling of connection establishment cause. In CR set I, the establishment cause is replaced by “*mps-PriorityAccess*” or “*highPriorityAccess*” in case of MPS redirection. In CR set II, the establishment cause is not changeddue to high priority redirection and it may use the establishment cause set by NAS later. One reason from R2-2106338 for not replacing the establishment cause is to avoid CT1 impact. It is actually unclear to the rapporteur that what would be the establishment cause from NAS in this kind of redirection.

**Question 1.2: For the connection establishment cause using in this procedure, which option does company prefer?**

* **Option 1 – Replace the establishment cause (CR set I)**
* **Option 2 – No change on establishment cause (CR set II)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Prefer Option** | **Comments** |
| Ericsson | 1 | The establishment cause should be replaced to ensure that the connection establishment is prioritized by the network.  In our understanding, the UE will only establish a new connection in the new cell after the release with redirect if the new cell belongs to a tracking area that lies outside the UE’s current registration area. AS would report the new tracking area to NAS which would trigger a tracking area update which in turn would cause AS to establish a new RRC connection. The establishment cause will therefore be set to mo-Signalling unless we override it.  If the new cell belongs to a tracking area within the registration area there won’t be any trigger from NAS to establish a new connection and the UE would just be camping in idle/inactive mode in the new cell. |
| Qualcomm Incorporated | Option 1 |  |
| Docomo | Option 1 | Without replacement of establishment cause, prioritized call admission/resource allocation cannot be realized until PDU Session/E-RAB setup, which is critical from our perspective.  Solution should enable differentiating the MPS redirected UE by no later than Message 3.  As for Rapporteur’s question about original establishment cause, we generally agree with Ericsson’s comment (mo-Signalling or stay idle/inactive). One case that might be added is the intra-registration-area redirection case, where the UE has uplink data pending. In that case the establishment cause will typically be mo-Data unless overridden.  In any case UEs with theses causes, unless overridden, are not prioritized by the network and may suffer from congestion even if they are MPS redirection UEs. |
| Huawei, HiSilicon | Option 1 |  |
| Nokia, Nokia Shanghai Bell | 1 (+LS to CT1) | Since this is about high-priority access, it's better to make that explicit. However, we should verify that this is stil in line with CT1 specifications so sending LS to CT1 would be good. |
| Samsung | Option 1 |  |
| Intel | Option 1 | Agree that cause value has to reflect the re-direction. |
| Apple | Option 1 | At least for the MPS case, it seems important to let the target eNB/gNB know that the establishment request is for MPS/high priority access. We are also not sure how the establishment cause is set (especially, for MT service which is one of the scenarios being targeted in the CRs) |
| Perspecta Labs | Option 1 | Without the replacement of the establishment cause value, the RRC request is susceptible to being processed without priority (or RRC Rejected) at the redirected cell at times of congestion. Using Option 1 is essential to the integrity of the proposed mechanism for MPS. |
| CATT | Option 1 | Share the same view. The establishment cause should be replaced in AS layer. Otherwise the network will not prioritize the connection. |
| ZTE | Option 2 | To answer the rapporteur’s question:   1. An authorized Service User using a UE with an MPS subscription can initiate MPS when it originates a session (See TS 22.153 clause 5.1). In the case of 5GS, the UE is assigned Access Identity 1 (AI1) and is entitled to the special Establishment Cause (mps-PriorityAccess) and priority treatment when it originates a session. In case of EPC, the UE is assigned Access Class 14 and is entitled to the special Establishment Cause (highPriorityAccess) and priority treatment when it originates a session.   => NAS layer will set the establishment cause as “mps-PriorityAccess” after redirection.   1. Unauthorized Service User using a UE that does not have an MPS subscription can initiate MPS for an originating session but priority treatment is only obtained after MPS is established for the session (See TS 22.153 clause 5.1). In this case the priority treatment is based on network control of the priority session as opposed to the UE subscription to MPS. 2. A terminating UE receives priority treatment for an incoming MPS session independent of whether the terminating UE has a subscription for MPS (See TS 22.153 clause 5.4). In this case the terminating UE receives priority treatment as for the above originating cases.   => NAS layer will set the establishment cause according to the access category after redirection, which maybe mo-Data/mo-Signaling. |
| vivo | Option 1 |  |

Finally companies are invite to provide other detail comment on the CRs or another aspect need to be discussed in this topic.

**Question 1.3: Do companies have further comments regarding to this issue and/or detail wording comments on the CR set I or CR set II?**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | In ZTE’s general solution (CR set II) the access barring check is always skipped which may not be desirable. In Perspecta’s MPS specific solution (CR set I) the access barring check is only skipped if the bit corresponding to the MPS access identity is set to 0, i.e. it is possible for the network to control whether access barring is skipped or not.  [ZTE] The intention is to have a unified mechanism workable for all the high priority access and the ACB check will only be skipped by UE when *highPriorityIndication* is set in Release with redirection. |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

## 3.2 HARQ configuration (R2 TEI)

In this section, we discuss HARQ configuration issue raised by the following paper.

[R2-2104987](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2104987.zip) Restrictions in the number of HARQ processes Nokia, Nokia Shanghai Bell discussion Rel-16 NR\_newRAT-Core, TEI16

Basically, it is proposed to extend the configuration granularity on the number of HARQ process as the sample ASN.1 code below.

PDSCH-ServingCellConfig ::= SEQUENCE {

nrofHARQ-ProcessesForPDSCH ENUMERATED {n2, n4, n6, n10, n12, n16} OPTIONAL, -- Need S

...,

[[

nrofHARQ-ProcessesForPDSCH-v16xy INTEGER (1..16) OPTIONAL -- Need R

]]

}

The observations and proposals from [R2-2104987](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2104987.zip) is copied below for reference. Companies are invited to provide comment on the proposals.

*Observation 1: It is mandatory for all NR UEs to support up to 16 HARQ processes for both uplink and downlink.*

*Observation 2: Current RRC doesn't allow full granularity for configuring amount of used PDSCH HARQ processes due to RAN1 decision in 2018.*

*Observation 3: CG and SPS allow more granular configuration of HARQ processes than PDSCH.*

*Observation 4: The limitations in number of configured HARQ processes can impact the peak UE throughput.*

*Proposal 1: Allow more granular configuration of PDSCH HARQ processes for UE.*

*Proposal 2: Adopt the more granular configuration of PDSCH HARQ processes for UE from Rel-16 onwards.*

*Proposal 3: RAN2 to adopt the CR according to Annex A changes (which has no impact to RAN1 specifications).*

**Question 2.1: Do companies agree the intention of the CR in** [**R2-2104987**](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2104987.zip) **? Any comment to the observations / proposals, or detail CR wording suggestion?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree the intention or not** | **Comments** |
| Qualcomm Incorporated | No | It looks like an optimization and should be avoided in release-16. |
| Huawei, HiSilicon | No | The issue mentioned in the contribution may not exist as UE does not do HARQ memory allocations based on configured HARQ processes. We don't see strong motivation to introduce this. |
| Nokia, Nokia Shanghai Bell | Yes (proponent) | We think this was just an oversight in Rel-15 and had it been noticed at the time, it could have been simple to have such signalling already at that time. Since the UE is mandated to support 16 HARQ processes, there's really no reason why any number of HARQ processes couldn't be supported in signalling as anyway UE has to support all of the cases. It's very strange to have such restrictions, especially since for SPS/CG there is nothing similar.  Just to point out that this case is something that primarily aids UE implementations: without this, network either has to limit the HARQ processes to 12, or always configure 16 but only use some of them (which can have impacts to HARQ operation and forces UE to use the resources to all 16 HARQ processes). Neither option is a good one so having the explicit configuration would help UEs to use their resources efficiently.  Finally, we would actually prefer to have the CRs from Rel-15 (since this IS a Rel-15 problem) but thought that it may be too late for that now, which is why we proposed to use Rel-16 instead. |
| Samsung | No | We see some point from the intention of the CR, but do not see the problem from the implementation at the moment. |
| Intel | No | Current configuration was agreed in RAN1 and if anything needs to change, it should be first initiated by RAN1. |
| Apple | No | As also mentioned by Nokia at the start of paper, UE is mandated to support up to 16 HARQ processes. Consequently, UE’s HARQ buffer has to be dimensioned based on this maximum number i.e. 16, the maximum peak data rate it indicated as part of UE capability as well as the number of CCs it supports for given BC. In other words, redefining finer granularity between n12 and n16 does NOT help UE to reduce buffer cost as it is determined by maximum ’n16’.  Also, how to implement the HARQ buffer sharing is a purely UE implementation issue. UE may implement with semi-static HARQ buffer sharing across different HARQ processes or dynamic buffer sharing across HARQ processes across different CCs. This was extensively discussed in LTE phase when defining the UE category. The reason is that BLER rate is typically 10% and the retransmitted HARQ processes is much smaller than the maximum HARQ processes number with taking into BLER rate. In other words, even with up to 16 HARQ process, it does not mean UE really dimensions Buffer based on n16, instead of some smaller number.  On the 2nd argument regarding the number of HARQ processes for CG-PUSCH or DL SPS, they might not be so relevant, since #HARQ process of CG-PUSCH/DL SPS is separately configured on top of the total number of HARQ process configured for a given UE. For example, UE is configured with n16 and can flexibility configure the first 13 for CG-PUSCH by setting ‘13' |
| Ericsson | No | This seems not a correction, hence could be considered in TEI17 |
| CATT | No | This is an optimization, but not a correction. |
| ZTE | No | It seems not a correction, and the issue should be discussed in RAN1 first. |
| vivo | No | Should discuss in RAN1 firstly. |
|  |  |  |
|  |  |  |
|  |  |  |

## 3.3 Half-duplex operation (R1 TEI-16)

In this section, we discuss the R2 SPEC impact from the R1 reply LS below.

[R2-2104717](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2104717.zip) Reply LS on half-duplex operation (R1-2104122; contact: Huawei) RAN1 LS in Rel-16 TEI16 To:RAN2

The LS content is copied below

----------------------------------------------------------------------------------------------------------

RAN1 has discussed the LS and has the following understanding/agreements:

* RAN1 agrees to use the per-serving-cell configuration of *directionalCollisionHandling* as currently implemented by RRC, and the collision handling operation is applied to the set of cell(s) configured/enabled by *directionalCollisionHandling* within the cell group.
* RAN1 also agrees that the UE does not expect any directional collision among the serving cells that the UE is not capable of simultaneous transmission and reception after the UE applies the directional collision handling within the set of cell(s).
* In addition, RAN1 agrees that

Rel-16 collision handling is applicable to TDD intra-band CA

* + UE can report *half-DuplexTDD-CA-SameSCS-r16* for a band combination that is intra-band only.
  + UE can report *half-DuplexTDD-CA-SameSCS-r16* in case of mix of intra- and inter-band CA if *simultaneousRxTxInterBandCA* is not included.

---------------------------------------------------------------------------------------------------------

The rapporteur understand that RAN2 has to update field description of the configuration and capability parameters according to the latest RAN1 agreements in the LS. There is two set of CR proposed below, the intention seems aligned at high level.

**CR Set A**

[R2-2105713](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105713.zip) CR on half-duplex operation Huawei, HiSilicon, CATT CR Rel-16 38.306 16.4.0 0590 - F TEI16

[R2-2105714](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105714.zip) CR on half-duplex operation Huawei, HiSilicon, CATT CR Rel-16 38.331 16.4.1 2642 - F TEI16

**CR Set B**

[R2-2104985](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2104985.zip) Corrections to directional collision handling in half-duplex operation Nokia, Nokia Shanghai Bell CR Rel-16 38.306 16.4.0 0575 - F TEI16

[R2-2104986](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2104986.zip) Corrections to directional collision handling in half-duplex operation Nokia, Nokia Shanghai Bell CR Rel-16 38.331 16.4.1 2596 - F TEI16

Rapporteur would like to check whether companies agree the intention of the CRs and which set of CR is preferable as baseline.

**Question 3.1: Which set of CR is preferred and any further comment on CR wording or coversheet?**

* **Option 1 – Take CR Set A (**[**R2-2105713**](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105713.zip) **and** [**R2-2105714**](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105714.zip)**) as baseline**
* **Option 2 – Take CR Set B (**[**R2-2104985**](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2104985.zip) **and** [**R2-2104986**](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2104986.zip)**) as baseline**
* **Option 3 – No CR is needed (please explain why)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred option** | **Comments** |
| Qualcomm Incorporated | Option 2 | Text is cleaner |
| Huawei, HiSilicon | Option 1 (Proponent) | For CR Set B, not sure how the CR R2-2104986 reflects the contents in RAN4 LS. UE can report *half-DuplexTDD-CA-SameSCS-r16* for intra- and inter-band CA BC if simultaneous transmission and reception is not supported, but in the CR “The network only configures this field for TDD serving cells that are using the same SCS and for cells where UE supports simultaneous transmission and reception”. |
| Nokia, Nokia Shanghai Bell | Option 2 | Proponent |
| Samsung | Option 2 but | RRC CR (i.e. R2-2104986) seems not needed i.e. network always configures UE according to capability. |
| Apple | Option 2 but | Slighly prefer Set B but OK to go with majority |
| Ericsson | Option 2bis | CR to 38.306 seems more accurately worded in Option 2.  But we do not think CR to 38331 is needed.  The added text proposed in R2-2104986 seems wrong  “…and for cells where UE supports simultaneous transmission and reception.” (should be “…does not support”?  The added text proposed in R2-2104986 is already covered in the RAN1 CR to 38.213, so not needed also in the 38331 field description.  And there is already existing reference to the RAN1 spec/section in the field description. |
| CATT | Option 1 | Agree with Huawei. |
| vivo | Option 1 |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

In addition, there is proposal to send reply LS to RAN1. However, maybe agree on R2 CRs is sufficient. Companies are invited to provide their view on this.

**LS out**

[R2-2105712](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105712.zip) Draft Reply LS on half-duplex operation Huawei, HiSilicon LS out Rel-16 TEI16 To:RAN1

**Question 3.2: Do companies agree to send reply LS to RAN1 and if yes, any comment/suggestion on the content of reply LS?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to send LS** | **Comments** |
| Qualcomm Incorporated | No | Not very essential. |
| Huawei, HiSilicon | Yes (Proponent) | The content can be updated based on the CR agreed in RAN2. |
| Nokia, Nokia Shanghai Bell | No | Note that the original RAN1 LS asked RAN2 to take their decisions into account, which we will do. There's simply no need to have an "info-dump" with RAN2 CR contents. If we have actualy questions or ambiguities, it's fine to send an LS but an LS just sengin "list of agreements" (which RAN1 has done several times) usually ends up being almost completely useless. |
| Samsung | No | No strong view but seems not essential. |
| Apple | No | We are sure an LS is needed |
| CATT |  | No strong view. |
| vivo | No |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## 3.4 List without ToAddMod (R2 ASN.1)

In this section, we discuss the handling on Extension of *candidateBeamRSList* based on the following papers.

[R2-2106115](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2106115.zip) Extension of candidateBeamRSList set to "release" MediaTek Inc., Intel Corporation discussion Rel-16

Basically, the issue comes from non-critical extension of a list without ToAddMod as the following ASN.1 code. (Simplified version of the real ASN.1 code)

BeamFailureRecoveryConfig ::= SEQUENCE {

candidateBeamRSList SEQUENCE (SIZE(1..16)) OF PRACH-ResourceDedicatedBFR OPTIONAL, -- Need M

candidateBeamRSListExt-v1610 SetupRelease{ CandidateBeamRSListExt-r16 } OPTIONAL -- Need M

}

CandidateBeamRSListExt-r16::= SEQUENCE (SIZE(1..48)) OF PRACH-ResourceDedicatedBFR

There is ambiguity when *candidateBeamRSListExt-v1610* is set to release, does this imply that the whole list is released or just the extended elements are released.

Note that in 38.331 6.1.3, we have the following general rules on this kind of list.

Upon reception of a list not using ToAddModList and ToReleaseList structure, the UE shall delete all entries of the list currently in the UE configuration before applying the received list and shall consider each entry as newly created. This applies also to lists whose size is extended (i.e. with a second list structure in the ASN.1 comprising additional entries). This implies that Need M should not be used for fields in the entries of these lists; if used, UE will handle such fields equivalent to a Need R.

We see 3 different solutions and would like to check companies view on this.

**Question 4.1: Which of the three options above should be adopted. (when *candidateBeamRSListExt-v1610* is set to release)**

* **Option 1: The UE releases the entire concatenated list, both the entries configured with *candidateBeamRSList* and the entries configured with *candidateBeamRSListExt-v1610***
* **Option 2: The UE releases only the extended entries that were configured with *candidateBeamRSListExt-v1610*.**
* **Option 3: The *release* branch is not used, and the UE treats *candidateBeamRSList* and *candidateBeamRSListExt-v1610* as a single concatenated field with Need M. The extended list *candidateBeamRSListExt-v1610* is only included when *candidateBeamRSList* is included and fully populated**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred option** | **Comments** |
| Qualcomm Incorporated | Option 2 | We prefer a simple solution in general.  Option 1 requires UE logic to release the entire list first and then configure new entries as configured in the same IE.  Option 3 is even bigger change. |
| Huawei, HiSilicon | 2 | Option 1 would mean a new feature to release the Rel-15 list, although it cannot be released in Rel-15 that would be strange. |
| Nokia, Nokia Shanghai Bell | Option 1 or Option 2 | Each options has its pros and cons but overall 1 might be the simplest to specify.  Option 2 is also OK to us as it's the closest to the original intent of the extension - the main drawback is that it requires more specification complexity (the CRs looked a bit messy).  We think option 3 would cause more problems so we would prefer not to use that. |
| Samsung | Option 3 with some modification | Option 3 can be re-written to indicate what network should do. That is, when signalling the original field (*candidateBeamRSList*), network does not omit the extension (*candidateBeamRSListExt-v1610*) when it wants same entries to remain unchanged. It avoids ambiguities. |
| Intel | Option 3 | We have a slight preference for option 3 and we think it is the simplest conceptually and in terms of having a general approach (which we should hopefully define in the near future) for extensions of lists that are not addMod lists. All of the options change the existing behaviour to some extent.  What we have is a single list of all entries (from both original and extension). We had previously agreed that non-addMod lists will be always replaced entirely when reconfigured.  Option 2 will only release the entries beyond the original list size rather than all the entries that were previously configured by the extension list. This is so because the entries previously configured by the extension list might now be in the original list size if the original list shrunk at some point. And releasing just the additional entries beyond the original size is not that helpful.  Since the it is treated as a single list containing all entries, and in line with our previous agreement on non-addMod lists, we think it is sufficient to have a common handling for the whole list to replace all entries from original and extension list when reconfigured. |
| Apple | Option 3 | In our view, it is better for the NW to always configure/operate ***candidateBeamRSListExt-v1610*** along with ***candidateBeamRSList.*** |
| Ericsson | Option 3 | We also have a preference for option 3. It seems to be the most logical way to go, despite it results in more field description text |
| CATT | Option 1 | In our understanding, normally NW releases these two together. We are not sure if there is use case where NW only release the ext list but not the one without ext.. | |
| ZTE | Option 1 or 2 | We are fine with either option 1 or 2. Option 1 seems the simplest way to go. Option 2 is also fine for us, but it requires UE/NW to maintain the two list separately. |
| vivo | Option 3 | The network handling is ok. |
|  |  |  |
|  |  |  |
|  |  |  |

There are CRs provided for different options. Companies are invited to comment on the following of CRs. (Based on your preferred option). The proponents have attempted to capture inter-operability impacts in the coversheets, but any comments in this direction are invited. All three options are ASN.1 BC.

[R2-2106116](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2106116.zip) Handling of candidateBeamRSListExt-v1610 set to “release” (option 1) MediaTek Inc., Intel Corporation draftCR Rel-16 38.331 16.4.1 F NR\_eMIMO-Core

[R2-2106117](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2106117.zip) Handling of candidateBeamRSListExt-v1610 set to “release” (option 2) MediaTek Inc., Intel Corporation draftCR Rel-16 38.331 16.4.1 F NR\_eMIMO-Core

[R2-2106118](file:///D:/Documents/3GPP/tsg_ran/WG2/RAN2/2105_R2_114-e/Docs/R2-2106118.zip) Handling of candidateBeamRSListExt-v1610 set to “release” (option 3) MediaTek Inc., Intel Corporation draftCR Rel-16 38.331 16.4.1 F NR\_eMIMO-Core

**Question 4.2: Any comments on above CR contents?**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei, HiSilicon | R2-2106117 is ok |
| Nokia, Nokia Shanghai Bell | If we go with option 1 it should still be possible to release the list AND configure it anew (using the legacy field) in the same message. |
| Samsung | See answer on Q4.1 above. |
| Apple | Prefer R2-2106118 |
| Ericsson | Also prefer R2-2106118. The order of the added sentences could maybe be reversed/changed. I.e.  “The network includes *candidateBeamRSListExt-v1610* set to *setup….* If *candidateBeamRSListExt-v1610* is absent… The *release* branch of *candidateBeamRSListExt-v1610* is not used. |
| vivo | Prefer R2-2106118 |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

## 3.5 IAB Misc.

Companies are invited to provide comments on the following IAB correction CRs.

[R2-2105645](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105645.zip) Resolving ambiguity in use of BAP routing ID Samsung Electronics GmbH CR Rel-16 38.331 16.4.1 2637 - F NR\_IAB-Core

**Question 5.1: Do companies agree the intention of the CR in** [**R2-2105645**](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105645.zip) **? Any further comment or suggestion on CR wording or coversheet?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company** | | **Agree the intention or not** | | **Comments** |
| Qualcomm Incorporated | | Yes | |  |
| Ericsson | Agree with intention but changes are needed | | Intention is correct, because in RRC specification the BAP routing ID is only used within the defaultUL-BAP-RoutingID, hence the “destination IAB node” will never be used in the BAP-address within BAP Routing ID, since the BAP routing ID will be only applicable to the UL.  However, we do not agree with the statement “In general,….When BAP-RoutingID is used to configure defaultUL-BAP-RoutingID”, because that is confusing. The BAP Routing ID in this ASN.1 version is only used within the defaultUL-BAP-RoutingID, hence it is obvious that is used only “When BAP-RoutingID is used to configure defaultUL-BAP-RoutingID”.  Additionally, the statement “In general” added at the beginning of the field description is misleading, because it seems to hint that those fields within BAP Routing ID can be used also for some other purposes in the current version of the ASN.1, which is not correct, as said above.  For this reason, we propose one of the following changes:  The ID of the IAB-donor-DU associated to the default uplink Routing ID .  or  The ID of the IAB-donor-DU used in the BAP header when applying the default uplink Routing ID | |
| Huawei, HiSilicon | | No | | There is no big difference with our without the change. |
| Nokia, Nokia Shanghai Bell | | No | | We normally have generic descriptions and this seems to make it very specific. The clarifications here seem more like Stage-2 or procedural descriptions rather than something that is required in field description. |
| Samsung | | Yes | | We are the proponent company. We would like to address some of the issues raised by Ericsson above (who we note agree with the intention of the CR).  We agree with Ericsson that the BAP routing ID has only one use in the RRC spec. However, we need to acknowledge that the BAP routing ID itself (as defined in the BAP spec) has multiple uses. Based on some recent RAN3 discussions it is possible that some new uses will make its way into the RRC spec – although of course this would not be in the Rel-16 spec.  Nevertheless, we do feel forward compatibility is important in this particular case. If we agreed what Ericsson were suggesting above, then for Rel-17 it is possible that significant changes would be needed to the IE definition and field descriptions. This is why we prefer to have a more general definition of the BAP routing ID (as is currently the case in the spec anyway), followed by the specific use in Rel-16 RRC. In a sense, the proposal from Ericsson above deviates more from the spirit of the current spec than our proposal and leaves no room for a general definition of the BAP routing ID.  With regards to the objection from Huawei above, we do not agree that there is no difference with or without the change. Without the change (i.e. leaving the spec as-is), incorrect information is given that the BAP address (used to configure the default UL path for a node) can be that of an IAB-node or an IAB-donor-DU, whereas in fact only the latter is true. |
| Apple | | Yes | | We think it is OK to define the BAP routing ID in more generic terms |
| vivo | | No | | The intention is ok, but we think there is nothing needs to be corrected. |
| CATT | | No | | Since there is no impact on practical implementation, we prefer no change to keep the specification stable. |
| ZTE | | No | | We agree the intention but the changes are not needed since the current description is clear and sufficient. On Samsung’s remark “Without the change (i.e. leaving the spec as-is), incorrect information is given that the BAP address (used to configure the default UL path for a node) can be that of an IAB-node or an IAB-donor-DU, whereas in fact only the latter is true.”, we think it is specified clearly that *defaultUL-BAP-RoutingID* is used for uplink in section 5.3.5.12 in 38.331 and *BAP-RoutingID* IE is only used within *defaultUL-BAP-RoutingID* IE in 38.331. So there is no misleading that the BAP address could be an IAB node’s BAP address when *BAP-RoutingID* is used to configure *defaultUL-BAP-RoutingID*. In our understanding, the reason why *bap-Address* IE could be the ID of a destination IAB-node or IAB-donor-DU is that *bap-Address* IE in 38.331 is referred by *BAP Address* IE insection 9.3.1.111 in 38.473. |
|  | |  | |  |
|  | |  | |  |
|  | |  | |  |
|  | |  | |  |
|  | |  | |  |

[R2-2105358](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105358.zip) Miscellaneous corrections on IAB vivo CR Rel-16 38.331 16.4.1 2619 - F NR\_IAB-Core

**Question 5.2: Do companies agree the intention of the CR in** [**R2-2105358**](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105358.zip) **? Any further comment or suggestion on CR wording or coversheet?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree the intention or not** | **Comments** |
| Qualcomm Incorporated | Yes |  |
| Ericsson | No | There is on NBC change which is not acceptable. If needed, field description to AvailabilityCombinationsPerCellIndex can be used to clarify that this field can only be configured up to 511. The rest is ok, but just editorial. |
| Huawei, HiSilicon | No | For the change "AvailabilityCombinationsPerCellIndex-r16 ::= INTEGER(0..maxNrofDUCells-r16-1": the “intention” is correct, but we should not change it. It impacts the ASN.1 encoding. Other corrections are purely editorial. |
| Nokia, Nokia Shanghai Bell | No (and the CR is ASN.1 NBC!) | The first change is incorrect for two reasons: 1) it's not possible to just add "-1" and expect compiler to resolve that. 2) Even worse, since the size is 513 currently and would become 512 with this change, this breaks ASN.1 encoding in NBC manner, which is not acceptable.  If restriction is made it must be made via field description (e.g. "network only configures *maxNrofDUCells* via this field" (=*availabilityCombinationsPerCellIndex-r16*)  Editorial changes seem OK. |
| Samsung | Yes | Minor corrections but all appear needed. |
| Apple | Neutral |  |
| vivo | Yes, but… | Proponent.  Agree with Ericsson and Nokia to rely on the field description to make the restriction via field description (e.g. "network only configures *maxNrofDUCells* via this field" (=*availabilityCombinationsPerCellIndex-r16*) |
| CATT | No | Agree with Ericsson and Huawei, the intention is correct but this is a NBC change. |
| ZTE | No | The change on “AvailabilityCombinationsPerCellIndex-r16” is NBC, thus should be avoided. The rest is fine. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## 3.6 Failure type for NR SCG (LTE)

In this section, we discuss the NR SCG failure type reporting in LTE based on the following paper.

[R2-2106464](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2106464.zip) Discussion on compatibility issue on failure type for NR SCG failure CATT discussion

It is pointed out that the use of R16 code point in UL enumerated-type may cause network error as observation 1 below.

*Observation 1 For a Rel-15 eNB, receiving an SCGFailureInformationNR message with a Rel-16 failure type will cause a “transfer syntax error” and discarding of the entire message, which further blocks the network from benefit from other field, e.g. to select a new SgNB based on the measResultFreqListNR-15 field.*

failureType-r15 ENUMERATED {

t310-Expiry, randomAccessProblem,

rlc-MaxNumRetx,

synchReconfigFailureSCG, scg-reconfigFailure,

srb3-IntegrityFailure, other-r16},

measResultFreqListNR-r15 MeasResultFreqListFailNR-r15 OPTIONAL,

//////////////////////////////////skip irrelevant codes//////////////////////////////////

[[

//////////////////////////////////skip irrelevant codes//////////////////////////////////

failureType-v1610 ENUMERATED {t312-Expiry, scg-lbtFailure,

beamFailureRecoveryFailure, bh-RLF-r16, spare4,

spare3, spare2, spare1} OPTIONAL

]]

**Question 6.1: Do companies agree the observation 1 in** [**R2-2106464**](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2106464.zip) **that R16 code point in *failureType-r15* may cause syntax error in R15 gNB? If yes, any suggested solution?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree or not** | **Comments** |
| Qualcomm Incorporated | Maybe | Most of the new release-16 failure causes are used only when the network is aware that related feature is used, e.g. NR-U, IAB. In those cases, we expect the network should support the “other-r16” and the corresponding new failure cause in failureType-v1610. Only exception seems "beamFailureRecoveryFailure".  We are ready to hear to network vendors’ input, but would like to avoid NBC for the UE.  [Huawei] For beamFailureRecoveryFailure, we provided some comments below. Basicaly we think a R16 UE may send “the value beamFailureRecoveryFailure in failureType-v1610 + the value other-r16 in failureType-r15“ to a r15 eNB, and then it may lead to a problem. |
| Ericsson | No | This does not represent an issue.  For an intra-vendor scenario, feature A is configured only if both MN and SN support it (regardless of the release they are implementing).  For the inter-vendor scenario (but also for intra-vendor scenario), the ASN.1 of the MN may be set to ignore the r16 extension and continue with the next branch. Thus, it is not true that this will always cause a transfer syntax error.  We think that this can be handled by network implementation and we can avoid having a NBC.  [Huawei] In case of intra-vendor scenairo, regarding the feature updates, our understandings are as below:   * for the r16 types “**t312-Expiry, scg-lbtFailure, beamFailureRecoveryFailure, bh-RLF-r16**”, the relevant features of “**t312-Expiry, scg-lbtFailure**“ only need NR updates * the relevant feature of “**beamFailureRecoveryFailure**” may or may not need NR updates * the relevant feature of “**bh-RLF-r16**” may need both NR and LTE updates.   For inter-vendor scenario, as we commented, r15 eNB will ignore r16 extension (from a r16 UE) for sure, but the problem is that r15 eNB has to decode the value other-r16 which is not defined in r15 TS 36.331. |
| Huawei, HiSilicon | Yes | **Firstly**, we think that for EN-DC, the following deployment is possible:   * R15 eNB * R16 gNB   For a R15 UE, it will only use legacy values for failureType-r15 and there is no problem for R15 eNB.  However, for a R16 UE, it may report failureType-v1610 and the value other-r16 for failureType-r15. For example, if the UE is configured with T312 by R16 gNB, and then it may happen that the UE suffers T312 expiry and thus include failureType-v1610 in the SCGFailureInformationNR message.  In addition, for R15 eNB+R15 gNB deployment, we are not sure whether a R16 UE can be able to include failureType-v1610. For example, the value beamFailureRecoveryFailure is related to eMIMO which was introduced in Rel-15, and a R16 UE may also report the value under R15 eNB+R15 gNB deployment. In this case, the issue mentioned above may also happen.  For R15 eNB, it may have unexpected behaviours, e.g. the eNB may consider the value other-r16 as an illegal value, and then the eNB may suffer a decode failure.  **Secondly**, in the past, the value other-r16 was directly added into failureType-r15. Before introducing the value, the failureType-r15 had no extension markers or spare values, so the 7th and 8th values may lead to unexpected behaviours for r15 eNB.  In general, we think the value other-r16 will cause critical problems to r15 eNB, so we suggest to address the issue.  **For solutions, we propose to remove the value other-r16 from failureType-r15.** Even if it is a NBC change, we think it is reasonable as the value is related to failureType-v1610 and currenlty the r16 IE should not be used in real networks. From eNB point of view, for R15 eNB, it just decodes legacy values in failureType-r15 and there is no problem; for R16 eNB, it ignores failureType-r15 and uses failureType-v1610 if both are received from the UE, and there is no problem  Following the solution, TS 36.331 and TS 38.331 will be impacted:   * TS 36.331: remove the value other-r16 from failureType-r15 * TS 38.331: update the procedural text |
| Nokia, Nokia Shanghai Bell | No | There is no real problem as Ericsson pointed out: If there is one, it should be discussed in RAN3. From RAN2 viewpoint there is no issue. |
| Samsung | No | There is no requirement that legacy gNB shall discard, and it seems a bad implementation i.e. no need for any change |
| Apple | No | We think that sort of handling of later releases is not avoidable by legacy gNBs |
| CATT | Yes | At first we want to clarify that the analysis from Ericsson is not correct.  For most features, the UE will indeed include new fields or values introduced by this feature only upon network configuration. **However the SCG failure report feature is special.**  The network cannot control whether a UE includes Rel-15 cause values or Rel-16 cause values into an *SCGFailureInformationNR* message, e.g. once an Rel-15 eNB wishes a Rel-16 UE to report SCG failure, it is incapable to prevent the UE from including a cause of “beamFailureRecoveryFailure” into the *SCGFailureInfoNR* message.  And as analysed by Huawei, deployment of Rel-15 eNB + Rel-16 en-gNB is also possible, where many more failure type value can be included. The Rel-15 eNB is neither possible to prevent it from happening.  And then what will happen in the network?  The eNB will regard the message as a falsely-encoded one. This is not at the level of “the gNB cannot understand the newly-introduced extension”, **this is at the level of “the gNB believes that the code is messed up by low layer and thus should not be processed”,** i.e. exactly what happens on the old eNB when we make an NBC change on the spec.  Thus the eNB will instantly discard the entire message, as it is not credible. **As the result, the gNB cannot realise that an SCG failure happens, let alone perform RRC connection reconfiguration based on the measurement report included in the *SCGFailureInformationNR* message.** This is a big problem.  And considering Rel-15 eNBs will continue to exist when Rel-16 UEs come into use, this problem will last for quite a long time.  For the solution, we are open on how to solve this issue. |
| ZTE | Maybe | From syntax aspect, we agree the issue exist. But we also agree with Ericsson that the issue can be handled by NW implementation. |
| vivo | No | We think good network implementation should handle it. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Furthermore, it is suggested to have some general principle for the enumerated-type ASN.1.

*Proposal 2 RAN2 to specify a principle on introducing an enumerated-type ASN.1 field with the number of logically-valid code points not identical to 2ⁿ, especially for the case that the field is mandatory present.*

**Question 6.2: Do companies agree to have some general principle for enumerated-type ASN.1 field. If yes, what would be the general principle? Is the principle in Proposal 2 of** [**R2-2106464**](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2106464.zip) **agreeable?**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We do not think that a principle should be specified. Each case should be treated case by case as we normally do when most of the time when implementing IEs and fields in the ASN.1 |
| Huawei, HiSilicon | We do not have strong views. For an ENUMERATED IE, if there is spare values or extension markers, it can be extended via BC manner; otherwise, it may be a risk to extend such IEs. |
| Nokia, Nokia Shanghai Bell | Nothing is really needed here: We discussed the extendibility earlier and this was the result. |
| Samsung | There is no need for a general principle i.e. we can see what to do on a case by case basis e.g.  a) It is up to network implementation what behaviour to apply  b) We can introduce network control i.e. have a field by which network can indicate that UE is allowed to signal a new value. |
| CATT | Yes. We suggest that if a type-enumerated field is mandatory present and possible to extend in the future, it should contain at least one spare value, which can be turned into an indicator “to ignore this field” once extended by a “-vXX” field. |
| ZTE | We are fine to have a principle and avoid such kind of extentsion in the future. |
| vivo | No strong view. |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

# 4 Discussion (Phase 2)

# 5 Conclusions

Base on the discussion in section 3 and 4, we propose the following:

Phase 1

Phase 2

# 6 References