3GPP TSG-RAN WG2 Meeting #109bis-e [R2-2003842](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003842.zip)

Elbonia, 20 – 30 April 2020

**Agenda item: 4.5**

**Source: Nokia (RAN2 Vice-chair )**

**Title: Summary and discussion of LTE contributions in AI 4.5**

**Document for: Discussion and Decision**

# 1 Brief scope of the LTE Rel-16 contributions

This document contains the summary of documents from agenda items 7.4 (“Further performance enhancement for LTE in high speed scenario”), 7.5 (“Other LTE Rel-16 WIs”), 7.6 (“LTE TEI16 enhancements”), 7.8 (“DL MIMO efficiency enhancements for LTE”), 7.9 (“LTE-based 5G Terrestrial Broadcast”) as referenced in Section 4.

# 2 LTE Rel-16 topic summaries

## 2.1 TEI16

The documents in [1] and [2] are the only inputs to TEI16 topics.

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| --- | --- |
| **Tdoc(s), Title, Company** | **Proposal(s)** |
| 1a) [R2-2002888](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002888.zip) LTE RLC out-of-order delivery configuration Samsung, LG Electronics Inc., Nokia, Nokia Shanghai Bell, Intel, Apple | **Discussed already in RAN2#109-e**  Clarification that RLC out-of-order delivery should only be used when t-Reordering is configured for the UE to avoid data loss. |
| 1b) [R2-2002887](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002887.zip) CR on RLC out-of-order delivery configuration Samsung, LG Electronics Inc., Nokia, Nokia Shanghai Bell, Intel, Apple | **CR for above**  Clarify that t-Reordering needs to be configured when RLC out-of-order delivery is used |

This topic was already discussed in RAN2#109-e but with not agreement, as shown below (from RAN2#109-e email discussion [202]):

**As conclusion of offline discussion [202] report in** [**R2-2001744**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2001744.zip)**:**

**- The CRs** [**R2-2001726**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2001726.zip) **and** [**R2-2001156**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2001156.zip) **are agreed.**

**- The CR** [**R2-2001508**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2001508.zip) **is not pursued (can be revisited if issues are identified)**

**- The CRs** [**R2-2001347**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2001347.zip) **and** [**R2-2001351**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2001351.zip) **are not pursued (can be revisited if issues are identified).**

The previous CRs were slightly different but still could not be agreed due to concerns from some companies. However, it seems that the content of the CRs is changed, the CRs are from only Rel-16 onwards, and there are more companies supporting the CRs. Therefore, it needs to be discussed if the revised versions could be agreeable.

**DISC S1\_1:** Discuss if the intent of [R2-2002888](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002888.zip) is agreeable. If needed, provided updated revision to CR [R2-2002887](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002887.zip).

## 2.2 DL MIMO efficiency enhancements for LTE

The CRs in [3] and [4] relate to the DL MIMO WI as shown below:

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| --- | --- |
| **Tdoc, Title, Company** | **Proposal(s)** |
| 2) [R2-2003546](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003546.zip), [R2-2003547](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003547.zip): “Introduction of UE capabilities for DL MIMO efficiency enhancement”, Huawei, Hisilicon | **New input**  Proposes how to capture the UE capabilities for the DL MIMO WI based on latest RAN1 progress (as per LS in [R1-2001485](http://3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100_e/Docs/R1-2001485.zip)). |

The capabilities seem straightforward, but may require checking. Therefore, it is proposed to attempt to endorse the current version as baseline pending any further updates from RAN1.

**Proposal S2\_1:** Endorse the CRs in [R2-2003546](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003546.zip), [R2-2003547](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003547.zip) as baseline for UE capabilities of DL MIMO efficiency enhancements for LTE.

## 2.3 LTE-based 5G Terrestrial Broadcast

The CRs in [5], [6] and [7] all concern the 0.37 kHz SCS for LTE-based 5G Terrestrial Broadcast WI:

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| --- | --- |
| **Tdoc, Title, Company** | **Proposal(s)** |
| 3a) [R2-2003544](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003544.zip): “Discussion on MCCH configuration for 0.37kHz SCS”, Huawei, Hisilicon  and  [R2-2003545](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003545.zip): “Clarification on MCCH configuration for 0.37kHz SCS”, Huawei, Hisilicon | **New proposal**  Discusses how to allow all subframes to carry MBMS in case of 0.37 kHz SCS (in dedicated MBMS carrier). |
| 3b) [R2-2003364](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003364.zip): “Correction on the configuration of subframe #0 and #5 for MCH in MBMS dedicated cell”, Qualcomm Technologies | **New proposal**  Proposes to define new structure to allow configuration of subframes #0 and #5 as MBMS MCCH subframes. |

It seems the intent of both is the same, but the approach is quite different. However, based on the description it seems there is an issue for the dedicated MBMS carrier with 0.37 kHz SCS configuration. The difference is that the CR in 3a) utilizes existing signalling with additional interpretation, whereas the CR in 3b) defines new signalling to solve the same issue. Since there are only two proposals, it is proposed to discuss whether one of the CRs can be adopted to resolve the identified issue.

**DISC S3\_1:** Discuss which approach can resolve the identified problem: Re-interpretation of existing signalling ([R2-2003545](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003545.zip)) or addition of new signalling ([R2-2003364](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003364.zip)).

# 3 Company comments to the contributions

## 3.1 TEI16 contributions

This section deals with DISC\_S1\_1:

***DISC S1\_1:*** *Discuss if the intent of* [*R2-2002888*](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002888.zip) *is agreeable. If needed, provided updated revision of* [*R2-2002887*](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002887.zip)*.*

Companies are requested to provide comments in the tables 1 and 2 below (one row for each new comment to better keep track of the discussion – please don’t edit the previous comments.

|  |  |
| --- | --- |
| **Company** | **Is the intent of** [R2-2002888](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002888.zip) **agreeable? If not, why?** |
| Qualcomm | The CR is about restricting network configuration. It is clear in current specification what is possible configuration and what is not. We do not list all the ‘bad’ configurations in the specification and as such rely on network on most part unless a configuration breaks the whole procedure as unintended consequence.  In the case of RLC out of order delivery in LTE when configured, the UE behaviour is clear, and the specification is not broken. The performance in terms of per packet reliability will likely degrade, but other metrics e.g. latency will be improved with such configuration. Network should be allowed to configure as such if intended.  Additionally, the feature in question is Rel-15. Having the correction only for Rel-16 creates interoperability for Rel-16 UE operating under Rel-15 eNB.  Therefore, we think the CR for network configuration restriction is not needed. |
| Samsung | **Yes. The CR is not about restricting network configuration but about clarification of the intended network behaviour since the current specification may break the legacy principle of AM DRB as unintended consequence.**  **The network should not configure RLC out-of-order delivery for normal UM and AM DRBs without t-Reordering to enable LTE PDCP out-of-order delivery which Qualcomm is proposing.**  **Such configuration is a new functionality RAN2 have never discussed before, which also breaks the principle of lossless delivery of AM DRB as possible data loss.**  **Note that there would be no interoperability issue for Rel-16 UE operating under Rel-15 eNB since such configuration has not been discussed in RAN2 and no related agreement has been made. If configured, then it would be a wrong network implementation.**  **As Qualcomm still propose a new functionality which RAN2 have never discussed before, the current RRC specification makes a reader get confused and misinterpret the RLC out-of-order delivery configuration. Hence, the CR is needed for clarification.**  **If any company support to allow RLC out-of-order delivery configuration to enable LTE PDCP out-of-order delivery with the risk of data loss, the proponent should provide the related agreement, if any.** |
| LG | **If the PDCP t-Reordering is not configured and the RLC our-of-order delivery is configured, it causes the packet loss for AM DRBs and causes the HFN desync for UM DRBs.**  **Actually, we believe that the network would not configure the PDCP t-Reordering and RLC our-of-order delivery to a DRB, but it would be good to clarify it to prevent the bad configuration.** |
| Qualcomm2 | Thanks Samsung and LG for further clarifications. Just so that we are on the same page, let me clarify that we are not proposing any new functionality. But as clarified by various companies during the last RAN2 meeting also, RLC out of order delivery without duplication was discussed and agreed as part of the HRLLC WI and it shouldn’t be reverted now. And it seemed the proponents of the CR also agreed to this in the last meeting. Note also that there are already Rel-15 UE capabilities *rlc-AM-Ooo-Delivery* and *rlc-UM-Ooo-Delivery* independent to PDCP duplication or any other feature.  Having said that, upon further checking the PDCP specification on potential HFN desync for UM, we are convinced there is a real issue. So, we now agree spec clarification would be beneficial and corrections need to be done to support proper behaviour.  While we agree with all the observations in the discussion paper R2-2002888 and we agree correction is needed, we are not fully convinced with the proposal as it is because we think the proposal and the corresponding CR is insufficient (see below). |
|  |  |

**Table 1. Intent of the CR**

|  |  |
| --- | --- |
| **Company** | **If the intent is agreeable, are there any issues with the proposed CR** [R2-2002887](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002887.zip)**?** |
| Samsung | To us, the current CR would be fine but still can be updated, if any concern. |
| Qualcomm2 | The proposed change in CR is insufficient because:   * In PDCP spec, the condition to allow PDCP reordering in TS 36.323 section 5.1.2.1.4 does not allow PDCP to perform reordering function by itself just based on PDCP t-reordering being configured. This should be added to PDCP spec (as either referring to when t-reordering is configured for PDCP; or alternatively referring to when rlc-outoforderdelivery is configured for associated RLC). * In RRC specification, conditional presence of PDCP t-reordering (Cond SetupS) should be updated to PDCP t-reordering be mandatory present when *rlc-OutofOrderDelivery* for associated RLC entity/entities is enabled.   The above changes should address the concerns from Samsung while not reverting what was already agreed in Rel-15.  If above suggestions are agreeable, it is better to do corrections from Rel-15, not just Rel-16. |
| Samsung | Thanks for your understanding.  Regarding QC’s proposed change, our opinion is as follows:   * The t-reordering configuration does not make UE perform t-reordering in LTE and NR. It just configures the value of t-reordering timer when the UE uses t-reordering according to the condition of PDCP specification. * As QC mentioned, the PDCP spec. specifies the condition when to use t-reordering as follows:  |  | | --- | | 5.1.2.1.4 Procedures for DRBs mapped on RLC AM or RLC UM, for LWA bearers and SLRB when the reordering function is used For DRBs mapped on RLC AM and RLC UM, for LWA bearers and when PDCP duplication is used, the PDCP entity shall use the reordering function as specified in this clause when:  - the PDCP entity is associated with two RLC entities; or  - the PDCP entity is configured for a LWA bearer; or  - the PDCP entity is associated with one AM RLC entity after it was, according to the most recent reconfiguration, associated with two AM RLC entities or configured for a LWA bearer without performing PDCP re-establishment; or  - the PDCP entity is configured with PDCP duplication.  For SLRBs mapped on RLC UM, the PDCP entity shall use the reordering function as specified in this clause when:  - the PDCP entity receives a PDCP SN which is not "0".  The PDCP entity shall not use the reordering function in other cases. |  * Note that t-reordering should be configured if the PDCP entity use t-reordering, i.e. one of the above conditions is met. * In this reason, our proposed change is as follows:  |  | | --- | | ***rlc-OutOfOrderDelivery***  Indicates that out-of-order delivery from RLC to PDCP is configured for this RLC entity as specified in TS 36.322 [7]. E-UTRAN sets this field to TRUE only when the associated PDCP entity is configured with t-Reordering. |  * In this respect, it seems that we don’t need to have further change for PDCP t-reordering be mandatory present when *rlc-OutofOrderDelivery* for associated RLC entity/entities is enabled. * Because our proposed change is that *rlc-OutofOrderDelivery* is set to TRUE only when the associated PDCP entity is configured with t-Reordering. It would be the same clarification as QC proposed. * If QC has some concern on the configuration of t-reordering, then we can update our proposed CR as follows:  |  | | --- | | ***rlc-OutOfOrderDelivery***  Indicates that out-of-order delivery from RLC to PDCP is configured for this RLC entity as specified in TS 36.322 [7]. E-UTRAN sets this field to TRUE only when the associated PDCP entity ~~is configured with~~ uses t-Reordering. |  * However, as many companies already co-sourced the original CR, we prefer to have the original one if this is acceptable to QC. * We have no strong opinion and are fine to do this correction from Rel-15. |

**Table 2. Details of the CR**

**Conclusions:** TBA

## 3.2 DL MIMO efficiency enhancements for LTE

This section deals with the capability signalling that is proposed to be endorsed as per Proposal S2\_1 as shown below:

***Proposal S2\_1:*** *Endorse the CRs in* [*R2-2003546*](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003546.zip)*,* [*R2-2003547*](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003547.zip) *as baseline for UE capabilities of DL MIMO efficiency enhancements for LTE.*

Companies are requested to indicate if there are any issues that require discussion within the CRs [R2-2003546](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003546.zip), [R2-2003547](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003547.zip) in the summary in the table below.

|  |  |
| --- | --- |
| **Company** | **Issues to discuss for UE capability CRs in** [R2-2003546](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003546.zip), [R2-2003547](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003547.zip) |
| Qualcomm | The capabilities are still under discussion in RAN1. Specifically for DL MIMO enh, the LS from RAN1 has this extra statement (highlighting added)   * As mentioned above, attached LTE features list is intermediate versions and there are a number of FFS points and brackets included in the lists. In addition, LTE MIMO part is an intermediate version without consensus, and hence there would be capability changes on the part. RAN1 kindly would like to ask RAN2 to design capability signaling corresponding to feature groups without such FFS point/bracket and not in LTE MIMO part first although they may also be updated after further discussion in RAN1. An updated LTE features list will be shared after RAN1#100bis-e meeting.   Given the above situation, we do not think we need to endorse the CR set yet. |
| Lenovo | We agree with Qualcomm that there is no need to endorse the CRs now due to the ongoing RAN1 discussion. Nonetheless, some comments can be made which can be taken into account in the next update:   * In the description of the capabilities their inter-dependencies should be clarified, e.g. support of addSRS-SymbolsFrequencyHopping-r16, addSRS-SymbolsAntennaSwitching-r16 is dependent on the support of addSRS-SymbolsNormal-r16. * Furthermore, each “addSRS” capability is dependent on the support of virtualCellID-r16 or vice versa. |
|  |  |

**Table 3. Issues to be discussed for UE capabilities fo DL MIMO efficiency enhancements for LTE**

**Conclusions:** TBA

## 3.3 LTE-based 5G Terrestrial Broadcast

This section deals with the discussion as per DISC S3\_1as shown below:

***DISC S3\_1:*** *Discuss which approach can resolve the identified problem: Re-interpretation of existing signalling (*[*R2-2003545*](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003545.zip)*) or addition of new signalling (*[*R2-2003364*](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003364.zip)*).*

Companies are requested to indicate in case there are objections to the proposals in the summary in the table below.

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| --- | --- |
| **Company** | **Which approach should be taken and why: Re-interpretation of existing signalling or addition of new signalling?** |
| Qualcomm | In our understanding, proposals in 3a) and 3b) are not the same.  Proposed changes in 3a) address mainly the issue of scheduling the MCCH whereas proposal in 3b) addresses the issue of scheduling MTCH. In both cases, we think network should be provided flexibility to schedule the MCCH and MTCH in the MBMS slot when subcarrier spacing of 0.37kHz is used.  If 3a) is not agreed, there will be ambiguity whether a 3ms MBMS slot carries MCCH or not in case the slot falls on boundary of two SFNs, i.e., 3ms MBMS slot includes three subframes (#9 of SFN1 and #0,#1 of SFN2) and if SFN1 carries the MCCH but SFN2 does not, then there is ambiguity. In this case network may indicate #9 does not carry MCCH and resolve the ambiguity but we think it is OK to keep the flexibility for network to schedule MCCH in #9.  If 3b) is not agreed, then 7 out of 13 3ms-MBMS slots cannot be used to schedule MTCH. This is huge performance degradation for subcarrier spacing of 0.37kHz to schedule MTCH in all 13 3ms-MBMS slots, new signalling is needed (i.e., to schedule MTCH in subframe #0 and #5 in dedicated MBMS). The reason we need new signalling is as follows:   1. Currently, there is no signalling to schedule MTCH in #0 and #5. 2. RAN2 already agreed that if any subframe in 3ms-MBMS slot is non-MBSFN subframe, then whole 3ms-MBMS slot is not valid and cannot be used. So, any MBMS slot including subframe #0 and #5 in dedicated MBMS cell are wasted in the configured MBMS area. Each MBMS area needs to configure separately MBSFN bitmap including #0 and #5.   Therefore, we think both sets of proposals / CRs are needed. After the proposal is agreed, we can discuss exact wordings of the CRs. |
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**Table 3. Resolving the issue of MCCH allocation for 0.37 kHz SCS in MBMS carrier**

**Conclusions:** TBA

# 4 Conclusions

**Agreements proposed to be agreed in this meeting (from all sub-topics)**

**Proposal S2\_1:** Endorse the CRs in [R2-2003546](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003546.zip), [R2-2003547](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003547.zip) as baseline for UE capabilities of DL MIMO efficiency enhancements for LTE.

**Open items proposed to be further discussed in this meeting (from all sub-topics)**

**DISC S1\_1:** Discuss if the intent of [R2-2002888](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002888.zip) is agreeable. If needed, provided updated revision to CR [R2-2002887](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002887.zip).

**DISC S3\_1:** Discuss which approach can resolve the identified problem: Re-interpretation of existing signalling ([R2-2003545](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003545.zip)) or addition of new signalling ([R2-2003364](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003364.zip)).

# 5 List of referenced documents

[1] [R2-2002887](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002887.zip) CR on RLC out-of-order delivery configuration Samsung, LG Electronics Inc., Nokia, Nokia Shanghai Bell, Intel, Apple CR Rel-16 36.331 16.0.0 4240 - F TEI16

[2] [R2-2002888](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002888.zip) LTE RLC out-of-order delivery configuration Samsung, LG Electronics Inc., Nokia, Nokia Shanghai Bell, Intel, Apple discussion TEI16

[3] [R2-2003546](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003546.zip) Introduction of UE capabilities for DL MIMO efficiency enhancement Huawei, Hisilicon CR Rel-16 36.331 16.0.0 4272 - F LTE\_DL\_MIMO\_EE-Core

[4] [R2-2003547](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003547.zip) Introduction of UE capabilities for DL MIMO efficiency enhancement Huawei, Hisilicon CR Rel-16 36.306 16.0.0 1756 - F LTE\_DL\_MIMO\_EE-Core

[5] [R2-2003364](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003364.zip) Correction on the configuration of subframe #0 and #5 for MCH in MBMS dedicated cell Qualcomm Technologies Int CR Rel-16 36.331 16.0.0 4259 - F LTE\_terr\_bcast-Core

[6] [R2-2003544](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003544.zip) Discussion on MCCH configuration for 0.37kHz SCS Huawei, Hisilicon discussion

[7] [R2-2003545](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003545.zip) Clarification on MCCH configuration for 0.37kHz SCS Huawei, Hisilicon CR Rel-16 36.331 16.0.0 4271 - F LTE\_terr\_bcast-Core