3GPP TSG-RAN WG4 Meeting #95e R4-2008611

E-meeting, 25 May – 5 June, 2020

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.174** | **CR** |  | **rev** |  | **Current version:** | **0.0.1** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | BFD requirements of IAB-MTs | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_newRAT-Core | | | | |  | ***Date:*** | | | 2019-09-10 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | RAN4 has already agreed to the details of BFD requirements for IAB-MTs. These requirements should also be captured in the IAB TS spec. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduce BFD requirements for IAB-MTs in IAB TS spec. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | IAB-MTs will not be able to perform BFD. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 12.3.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | |  | | |
| ***affected:*** | | **x** |  | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

### <Start of Change>

### 12.3.2 Link Recovery Procedure

#### 12.3.2.1 Introduction

The UE requirements in sub-clause 8.5.1 [6] apply for IAB-MT.

#### 12.3.2.2 Requirements for SSB based beam failure detection

##### 12.3.2.2.1 Introduction

The UE requirements in sub-clause 8.5.2.1 [6] apply for IAB-MT.

##### 12.3.2.2.2 Minimum requirement

IAB-MT shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set  estimated over the last TEvaluate\_BFD\_SSB ms period becomes worse than the threshold Qout\_LR\_SSB within TEvaluate\_BFD\_SSB ms period.

The value of TEvaluate\_BFD\_SSB is defined in Table 8.5.2.2-1 for FR1.

The value of TEvaluate\_BFD\_SSB is defined in Table 8.5.2.2-2 for FR2 with scaling factor N= 8.

For FR1,

- , when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB.

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- , when BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P = Psharing factor, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC period (TSSB = TSMTCperiod).

- , when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TSSB < 0.5\*TSMTCperiod

- , when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TSSB = 0.5\*TSMTCperiod

- , when the BFD-RS resource is partially overlapped with measurement gap (TSSB <MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap.

- , when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

* Psharing factor = 1
* if all of the reference signals configured for BFD outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or
* if all of the reference signal configured for BFD outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped by with the SSB symbols indicated by SSB-ToMeasure and 1 symbol before each consecutive SSB symbols indicated by SSB-ToMeasure and 1 symbol after each consecutive SSB symbols indicated by SSB-ToMeasure, given that SSB-ToMeasure is configured;
* Psharing factor = 3, otherwise.

If the IAB-MT is not capable of 4 SMTC configurations per frequency [15], and is provided with higher layer signaling of smtcj, where 1≤*j*≤2 [15], then TSMTCperiod follows smtcjmax where jmax is the maximum value of all j for which smtcj has been configured.

If the IAB-MT is capable of 4 SMTC configurations per frequency [15], and is provided with higher layer signaling of smtcj, where 1≤*j*≤4 [15], then TSMTCperiod follows smtcjmax where jmax is the maximum value of all j for which smtcj has been configured.

Longer evaluation period would be expected if the combination of BFD-RS resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

**Table 8.5.2.2-1: Evaluation period TEvaluate\_BFD\_SSB for FR1**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_BFD\_SSB (ms)** |
| no DRX | Max(50, Ceil(5 × P) × TSSB) |
| Note: TSSB is the periodicity of SSB in the set . | |

**Table 8.5.2.2-2: Evaluation period TEvaluate\_BFD\_SSB for FR2**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_BFD\_SSB (ms)** |
| no DRX | Max(50, Ceil(5 × P × N) × TSSB) |
| Note: TSSB is the periodicity of SSB in the set . | |

##### 12.3.2.2.3 Measurement restriction for SSB based beam failure detection

The UE requirements in sub-clause 8.5.2.3 [6] apply for IAB-MT.

#### 12.3.2.3 Requirements for CSI-RS based beam failure detection

##### 12.3.2.3.1 Introduction

The UE requirements in sub-clause 8.5.3.1 [6] apply for IAB-MT.

##### 12.3.3.2.3.2 Minimum requirement

IAB-MT shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in set  estimated over the last TEvaluate\_BFD\_CSI-RS ms period becomes worse than the threshold Qout\_LR\_CSI-RS within TEvaluate\_BFD\_CSI-RS ms period.

The value of TEvaluate\_BFD\_CSI-RS is defined in Table 8.5.3.2-1 for FR1.

The value of TEvaluate\_BFD\_CSI-RS is defined in Table 8.5.3.2-2 for FR2 with N=1. The requirements of TEvaluate\_BFD\_CSI-RS apply provided that the CSI-RS for BFD is not in a resource set configured with repetition ON. The requirements shall not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for BFD and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR1,

- , when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS.

- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P = 1, when the BFD-RS resource is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- , when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is not overlapped with SMTC occasion (TCSI-RS < MGRP)

- , when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P = Psharing factor, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- , when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TCSI-RS < 0.5 × TSMTCperiod

- , when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TCSI-RS = 0.5 × TSMTCperiod

- , when the BFD-RS resource is partially overlapped with measurement gap (TCSI-RS < MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap.

- , when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

- Psharing factor = 3**.**

If the IAB-MT is not capable of 4 SMTC configurations per frequency [15], and is provided with higher layer signaling of smtcj, where 1≤*j*≤2 [15], then TSMTCperiod follows smtcjmax where jmax is the maximum value of all j for which smtcj has been configured.

If the IAB-MT is capable of 4 SMTC configurations per frequency [15], and is provided with higher layer signaling of smtcj, where 1≤*j*≤4 [15], then TSMTCperiod follows smtcjmax where jmax is the maximum value of all j for which smtcj has been configured.

Note: The overlap between CSI-RS for BFD and SMTC means that CSI-RS for BFD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the BFD-RS resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

The values of MBFD used in Table 8.5.3.2-1 and Table 8.5.3.2-2 are defined as

- MBFD = 10, if the CSI-RS resource(s) in set  used for BFD is transmitted with Density = 3.

**Table 8.5.3.2-1: Evaluation period TEvaluate\_BFD\_CSI-RS for FR1**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_BFD\_CSI-RS (ms)** |
| no DRX | Max(50, [MBFD × P] × TCSI-RS) |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . | |

**Table 8.5.3.2-2: Evaluation period TEvaluate\_BFD\_CSI-RS for FR2**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_BFD\_CSI-RS (ms)** |
| no DRX | Max(50, [MBFD × P × N] × TCSI-RS) |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . | |

##### 12.3.2.3.3 Measurement restrictions for CSI-RS based beam failure detection

The UE requirements in sub-clause 8.5.3.3 [6] apply for IAB-MT.

#### 12.3.2.4 Minimum requirement for L1 indication

When the radio link quality on all the RS resources in set  is worse than Qout\_LR, layer 1 of the UE shall send a beam failure instance indication to the higher layers. A layer 3 filter may be applied to the beam failure instance indications as specified in TS 38.331 [2].

The beam failure instance evaluation for the RS resources in set  shall be performed as specified in clause 6 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least TIndication\_interval\_BFD.

TIndication\_interval\_BFD is max(2ms, TSSB-RS,M) ) or max(2ms, TCSI-RS,M), where TSSB-RS,M and TCSI-RS,M is the shortest periodicity of all RS resources in set  for the accessed cell, corresponding to either the shortest periodicity of the SSB in the set  or CSI-RS resource in the set .

### <End of Change>