**3GPP TSG RAN WG4 Meeting #95e R4-2008601**

**Electronic Meeting, May 25th – Jun. 5th, 2020**

**Agenda Item:** 6.5.3.5

**Source:** Samsung

**Title:** TP to TS 38.174 v0.0.1: Beam Candidate Detection Requirements for IAB MT

**Document for:** Approval

1. Introduction

In RAN#86 according to the approved WF it was agreed that RAN4 will introduce RLM and BFD/BFR requirements for the MT of local area type [1]. According to the chairman, some RAN4 core specifications including TS 38.174 will be submitted to ITU where no TBD or [] should appear in the June version. Considering the timeline is appoarching, we present the TP to revisit the TBD part in CBD requirement where the modification is aligned with our proposal in the discussion paper. The final version of this TP will base on the consensus reached in the RAN4 online meeting and may need to be revised if different proposal is agreed.

Section 2 provides text proposal on the candidate beam detection (CBD) requirement in IAB specification TS 38.171 v0.0.01 (Integrated access and backhaul radio transmission and reception) for proposing FR2 sweeping factor N instead of TBD. This TP is revised on the basis of the version [2] after RAN4#94bis-e where modifications are highlighted with different backcolor.

# Text Proposal

--------------------------------------------------Start of TP------------------------------------------------------

#### 12.3.2.5 Requirements for SSB based candidate beam detection

##### 12.3.2.5.1 Introduction

The requirements in this clause apply for each SSB resource in the set  configured for a serving cell, provided that the SSBs configured for candidate beam detection are actually transmitted within IAB-MT active DL BWP during the entire evaluation period specified in clause 12.3.2.5.2.

##### 12.3.2.5.2 Minimum requirement

Upon request the IAB-MT shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set  estimated over the last TEvaluate\_CBD\_SSB ms period becomes better than the threshold Qin\_LR provided SSB\_RP and SSB Ês/Iot are according to Annex Table in B.2.4.1 [TS 38.133 v16.3.0] for a corresponding band.

The IAB-MT shall monitor the configured SSB resources using the evaluation period in table 12.3.2.5.2-1 and 12.3.2.5.2-2 which is applicable to the non-DRX mode only.

The value of TEvaluate\_CBD\_SSB is defined in Table 12.3.2.5.2-1 for FR1.

The value of TEvaluate\_CBD\_SSB is defined in Table 12.3.2.5.2-2 for FR2 with scaling factor N=6.

Where,

For FR1,

- $P=\frac{1}{1-\frac{T\_{SSB}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency or 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,

- $P=\frac{1}{1-\frac{T\_{SSB}}{T\_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is Psharing factor , when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC period (TSSB = TSMTCperiod).

- $P=\frac{1}{1-\frac{T\_{SSB}}{MRGP} - \frac{T\_{SSB}}{T\_{SMTCperiod}}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS 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

- $P=\frac{P\_{sharing factor}}{1-\frac{T\_{SSB}}{MRGP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS 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

- $P=\frac{1}{1-\frac{T\_{SSB}}{Min(MRGP,T\_{SMTCperiod})}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap

- $P=\frac{P\_{sharing factor}}{1-\frac{T\_{SSB}}{MRGP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS 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 CBD outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or
* if all of the reference signal configured for CBD 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.

**Table 12.3.2.5.2-1: Evaluation period TEvaluate\_CBD\_SSB for FR1**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_SSB (ms)**  |
| non-DRX | Ceil(3 × P) × TSSB |
| Note: TSSB is the periodicity of SSB in the set .  |

**Table 12.3.2.5.2-2: Evaluation period TEvaluate\_CBD\_SSB for FR2**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_SSB (ms)**  |
| non-DRX | Ceil(3 × P × N) × TSSB |
| Note: TSSB is the periodicity of SSB in the set . |

##### 12.3.2.5.3 Measurement restriction for SSB based candidate beam detection

The measurement restriction for UE SSB based candidate beam detection specified in sub-clause 8.5.5.3 [TS 38.133 v16.3.0] is equally applied to IAB-MT.

#### 12.3.2.6 Requirements for CSI-RS based candidate beam detection

##### 12.3.2.6.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set  configured for a serving cell, provided that the CSI-RS resources configured for candidate beam detection are actually transmitted within IAB MT active DL BWP during the entire evaluation period specified in clause 12.3.2.6.2.

##### 12.3.2.6.2 Minimum requirement

Upon request the IAB-MT shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in set  estimated over the last TEvaluate\_CBD\_CSI-RS [ms] period becomes better than the threshold Qin\_LR within TEvaluate\_CBD\_CSI-RS [ms] period provided CSI-RS Ês/Iot is according to Annex Table in B.2.4.2 [TS 38.133 v16.3.0] for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in table 12.3.2.6.2-1 and 12.3.2.6.2-2 which is applicable to the non-DRX mode only.

The value of TEvaluate\_CBD\_CSI-RS is defined in Table 12.3.2.6.2-1 for FR1.

The value of TEvaluate\_CBD\_CSI-RS is defined in Table 12.3.2.6.2-2 for FR2 with scaling factor N=6.

For FR1,

- $P=\frac{1}{1-\frac{T\_{CSI-RS}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency or inter-frequency[ or inter-RAT measurements], which are overlapping with some but not all occasions of the CSI-RS; and

- 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 candidate beam detection RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- $P=\frac{1}{1-\frac{T\_{CSI-RS}}{MRGP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is not overlapped with SMTC occasion (TCSI-RS < MGRP)

- $P=\frac{1}{1-\frac{T\_{CSI-RS}}{T\_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P = 3, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- $P=\frac{1}{1-\frac{T\_{CSI-RS}}{MRGP} - \frac{T\_{CSI-RS}}{T\_{SMTCperiod}}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS 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

- $P=\frac{3}{1-\frac{T\_{CSI-RS}}{MRGP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS 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

- $P=\frac{1}{1-\frac{T\_{CSI-RS}}{Min(MRGP, T\_{SMTCperiod})}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap

- $P=\frac{3}{1-\frac{T\_{CSI-RS}}{MRGP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

Longer evaluation period would be expected if the CSI-RS is on the same OFDM symbols with RLM, BFD, BM-RS, or other CBD-RS, according to the measurement restrictions defined in clause 12.3.2.6.3.

The values of MCBD used in Table 12.3.2.6.2-1 and Table 12.3.2.6.2-2 are defined as

- MCBD = 3, if the CSI-RS resource configured in the set  is transmitted with Density = 3.

**Table 12.3.2.6.2-1: Evaluation period TEvaluate\_CBD\_CSI-RS for FR1**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluateC\_CBD\_CSI-RS (ms)**  |
| non-DRX | Max(25, Ceil(MCBD × P) × TCSI-RS) |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set .  |

**Table 12.3.2.6.2-2: Evaluation period TEvaluate\_CBD\_CSI-RS for FR2**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_CSI-RS (ms)**  |
| non-DRX | Max(25, Ceil(MCBD × P × N) × TCSI-RS) |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . |

##### 12.3.2.6.3 Measurement restriction for CSI-RS based candidate beam detection

The measurement restriction for UE CSI-RS based candidate beam detection specified in sub-clause 8.5.6.3 [TS 38.133 v16.3.0] is equally applied to IAB-MT.

#### 12.3.2.7 Scheduling availability of IAB-MT during beam failure detection

The scheduling availability restrictions during UE beam failure detection specified in sub-clause 8.5.7 [TS38.133 v16.3.0] is equally applied to the IAB-MT.

#### 12.3.2.8 Scheduling availability of IAB-MT during candidate beam detection

The scheduling availability restrictions during UE candidate beam detection specified in sub-clause 8.5.8 [TS38.133 v16.3.0] is equally applied to the IAB-MT.

--------------------------------------------------End of TP------------------------------------------------------

1. References
2. RP-193199, Proposed Way Forward on RRM Requirements for the IAB Project, Qualcomm Inc, AT&T, KDDI, Samsung, Telstra, Ericsson
3. R4-2004801, TS 38.174 v0.0.1, Qualcomm Inc, after RAN4 #94e