

**TSG-RAN Meeting #13  
Beijing, China, 18 - 21 September 2001**

**RP-010671**

**Title:** Agreed CRs (Release '99 and Rel-4 category A) to TS 25.331 (8)

**Source:** TSG-RAN WG2

**Agenda item:** 8.2.3

**NOTE:** These CRs replace CR 0925r2 and CR 0926 in RP-010545.

Doc-1st-	Status-	Spec	CR	Rev	Phase	Subject	Cat	Version	Versio
R2-012212	agreed	25.331	0925	3	R99	Intra-frequency measurements	F	3.7.0	3.8.0
R2-012213	agreed	25.331	0926	1	Rel-4	Intra-frequency measurements	A	4.1.0	4.2.0

## CHANGE REQUEST

⌘ **25.331 CR 925** ⌘ ev **r3** ⌘ Current version: **3.7.0** ⌘

For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.

**Proposed change affects:** ⌘ (U)SIM  ME/UE  Radio Access Network  Core Network

<b>Title:</b>	⌘ Intra-frequency measurement corrections		
<b>Source:</b>	⌘ TSG-RAN WG2		
<b>Work item code:</b>	⌘ TEI	<b>Date:</b>	⌘ 2001-09-14
<b>Category:</b>	⌘ <b>F</b>	<b>Release:</b>	⌘ R99
Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:	
<b>F</b> (correction)		2 (GSM Phase 2)	
<b>A</b> (corresponds to a correction in an earlier release)		R96 (Release 1996)	
<b>B</b> (addition of feature),		R97 (Release 1997)	
<b>C</b> (functional modification of feature)		R98 (Release 1998)	
<b>D</b> (editorial modification)		R99 (Release 1999)	
Detailed explanations of the above categories can be found in 3GPP <a href="#">TR 21.900</a> .		REL-4 (Release 4)	
		REL-5 (Release 5)	

<b>Reason for change:</b>	⌘ Some inconsistencies in the description of the events needed to be corrected. The use of the variables "TRIGGERED_1A_EVENT"... needed also to be clarified in case several 1a... events are configured.
<b>Summary of change:</b>	⌘ Introduction of new IE "Periodical Reporting running" in TRIGGERED_1A_EVENT and TRIGGERED_1C_EVENT to describe that during periodical reporting phase no further reports are to be sent due to trigger · Clarification on inclusion of elements in "intra-frequency measurement event results" · <a href="#">10.3.7.38</a> : UTRA carrier RSSI cannot be used as measurement quantity in any of the 1x events. It is therefore proposed not to allow for it to be specified as measurement quantity when configuring an intra-frequency measurement. · <a href="#">13.4.27a-13.4.27b</a> : it is clarified that there is one variable of type "TRIGGERED_1A_EVENT" per 1a event configured in the UE. The singular form was used instead of the plural in the names of the variables, since such a variable contains information related to one configured event. · <a href="#">14.1.1</a> : Ec/Io is said to be a measurement quantity, while in the tabular, as well as in <a href="#">25.215</a> , <a href="#">25.225</a> , Ec/No is the measurement quantity that is considered. The text is changed, and a reference to those two specifications is added regarding the description of the measurement quantities. · <a href="#">14.1.2.1</a> , <a href="#">14.1.2.2</a> , <a href="#">14.1.2.3</a> , <a href="#">14.1.2.5</a> , <a href="#">14.1.2.6</a> : in the leaving triggering conditions, the $\geq$ (resp. $\leq$ ) are changed to $>$ (resp. $<$ ), in order for those conditions to be the exact complementary of the triggering conditions. · <a href="#">14.1.2.1</a> and <a href="#">14.1.2.3</a> : at two places, it reads "reporting interval" where it should read "amount of reporting". This is corrected. Moreover, the text "if the value of "Reporting deactivations threshold" for this event is <b>greater than</b> the current number of cells in the active set or equal to 0" is changed to "if the value of "Reporting deactivations threshold"

	<p>for this event is <b>greater or equal to</b> the current number of cells in the active set or equal to 0” since otherwise the case where “Reporting deactivation threshold” is equal to 1 would not make sense.</p> <p>· <b>14.1.2.3:</b> it reads “if the value of "Replacement activation threshold" for this event is <b>lower</b> than the current number of cells in the active set or equal to 0". This is in contradiction with the text below the figure in the same section: “It is activated if the number of active cells is <b>equal to or greater than a replacement activation threshold</b> parameter that UTRAN signals to the UE in the MEASUREMENT CONTROL message”. A correction is proposed to make the text consistent.</p> <p>· <b>14.1.6:</b> the section is updated to reflect what are the values that can be reported by the UE in an intra-frequency measurement.</p> <p>This CR has an isolated impact on intra-frequency measurement reporting. Correction to a function where the specification was not sufficiently explicit. Would not affect implementations behaving like indicated in the CR, would affect implementations supporting the corrected functionality otherwise.</p>													
<b>Consequences if not approved:</b>	⌘	Inconsistencies in the text describing the 1x events.												
<b>Clauses affected:</b>	⌘	10.3.7.38, 10.3.7.39, 11.3, 13.4.27a, 13.4.27b, 13.4.27c, 13.4.27d, 13.4.27e, 13.4.27f, 14.1.1, 14.1.2, 14.1.2.1, 14.1.2.2, 14.1.2.3, 14.1.2.4, 14.1.2.5, 14.1.2.6, 14.1.4, 14.1.5, 14.1.5.3, 14.1.6												
<b>Other specs affected:</b>	⌘	<table border="0"> <tr> <td><input type="checkbox"/></td> <td>Other core specifications</td> <td>⌘</td> <td>25.331 v4.1.0, CR 926r1</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Test specifications</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>O&amp;M Specifications</td> <td></td> <td></td> </tr> </table>	<input type="checkbox"/>	Other core specifications	⌘	25.331 v4.1.0, CR 926r1	<input type="checkbox"/>	Test specifications			<input type="checkbox"/>	O&M Specifications		
<input type="checkbox"/>	Other core specifications	⌘	25.331 v4.1.0, CR 926r1											
<input type="checkbox"/>	Test specifications													
<input type="checkbox"/>	O&M Specifications													
<b>Other comments:</b>	⌘													

**How to create CRs using this form:**

Comprehensive information and tips about how to create CRs can be found at: [http://www.3gpp.org/3G\\_Specs/CRs.htm](http://www.3gpp.org/3G_Specs/CRs.htm). Below is a brief summary:

- 1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
- 2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under <ftp://ftp.3gpp.org/specs/> For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
- 3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

### 10.3.7.38 Intra-frequency measurement quantity

The quantity the UE shall measure in case of intra-frequency measurement. It also includes the filtering of the measurements.

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Filter coefficient	MP		Filter coefficient 10.3.7.9	
CHOICE mode	MP			
>FDD				
>>Measurement quantity	MP		Enumerated(CPICH Ec/N0, CPICH RSCP, Pathloss, UTRA Carrier RSSI)	<del>If used in inter-system measurement quantity only Ec/N0 and RSCP is allowed. If used in inter-frequency measurement quantity RSSI is not allowed in this release.</del>
>TDD				
>>Measurement quantity list	MP	1 to 4		
>>>Measurement quantity	MP		Enumerated(Primary CCPCH RSCP, Pathloss, Timeslot ISCP, UTRA Carrier RSSI)	<del>If used in inter-frequency measurement quantity RSSI is not allowed.</del>

### 10.3.7.39 Intra-frequency measurement reporting criteria

The triggering of the event-triggered reporting for an intra-frequency measurement. All events concerning intra-frequency measurements are labelled 1x where x is a, b, c....

Event 1a: A Primary CPICH enters the Reporting Range (FDD only).

Event 1b: A Primary CPICH leaves the Reporting Range (FDD only).

Event 1c: A Non-active Primary CPICH becomes better than an active Primary CPICH (FDD only).

Event 1d: Change of best cell ~~[Note 1]~~ (FDD only).

Event 1e: A Primary CPICH becomes better than an absolute threshold (FDD only).

Event 1f: A Primary CPICH becomes worse than an absolute threshold (FDD only).

Event 1g: Change of best cell in TDD.

Event 1h: Timeslot ISCP below a certain threshold (TDD only).

Event 1i: Timeslot ISCP above a certain threshold (TDD only).

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Parameters required for each event	OP	1 to <maxMeasEvent>		
>Intra-frequency event identity	MP		Intra-frequency event identity 10.3.7.34	
>Triggering condition 1	CV-clause 0		Enumerated(Active set cells, Monitored set cells, Active set cells and monitored set cells)	Indicates which cells can trigger the event
>Triggering condition 2	CV-clause 6		Enumerated(Active set cells, Monitored set cells, Active set cells and monitored set cells, Detected set cells, Detected set cells and monitored set cells)	Indicates which cells can trigger the event
>Reporting Range Constant	CV-clause 2		Real(0..14.5 by step of 0.5)	In dB. In event 1a,1b.
>Cells forbidden to affect Reporting range	CV-clause 1	1 to <maxCellMeas>		In event 1a,1b
>>CHOICE mode	MP			
>>>FDD				
>>>>Primary CPICH info	MP		Primary CPICH info 10.3.6.60	
>>>TDD				
>>>>Primary CCPCH info	MP		Primary CCPCH info 10.3.6.57	
>W	CV-clause 2		Real(0.0..2.0 by step of 0.1)	
>Hysteresis	MP		Real(0..7.5 by step of 0.5)	In dB.
>Threshold used frequency	CV-clause 3		Integer (-115..165)	Range used depend on measurement quantity. CPICH RSCP -115..-25 dBm CPICH Ec/No -24..0 dB Pathloss 30..165dB ISCP -115..-25 dBm

Information Element/Group name	Need	Multi	Type and reference	Semantics description
>Reporting deactivation threshold	CV-clause 4		Integer(0, 1, 2, 3, 4, 5, 6, 7)	In event 1a Indicates the maximum number of cells allowed in the active set in order for event 1a to occur. 0 means not applicable
>Replacement activation threshold	CV-clause 5		Integer(0, 1, 2, 3, 4, 5, 6, 7)	In event 1c Indicates the minimum number of cells allowed in the active set in order for event 1c to occur. 0 means not applicable
>Time to trigger	MP		Time to trigger 10.3.7.64	Indicates the period of time between the timing of event detection and the timing of sending Measurement Report. Time in ms
>Amount of reporting	CV-clause 7		Integer(1, 2, 4, 8, 16, 32, 64, Infinity)	
>Reporting interval	CV-clause 7		Integer(0, 250, 500, 1000, 2000, 4000, 8000, 16000)	Indicates the interval of periodical reporting when such reporting is triggered by an event. Interval in milliseconds. 0 means no periodical reporting
>Reporting cell status	OP		Reporting cell status 10.3.7.61	

Condition	Explanation
Clause 0	The IE is mandatory if "Intra-frequency event identity" is set to "1b" or "1f", otherwise the IE is not needed
Clause 1	The IE is optional if "Intra-frequency event identity" is set to "1a" or "1b", otherwise the IE is not needed
Clause 2	The IE is mandatory if "Intra-frequency event identity" is set to "1a" or "1b", otherwise the IE is not needed
Clause 3	The IE is mandatory if "Intra-frequency event identity" is set to , "1e", "1f", "1h" or "1i", otherwise the IE is not needed
Clause 4	The IE is mandatory if "Intra-frequency event identity" is set to "1a", otherwise the IE is not needed
Clause 5	The IE is mandatory if "Intra-frequency event identity" is set to "1c", otherwise the IE is not needed
Clause 6	The IE is mandatory if "Intra-frequency event identity" is set to "1a" or "1e".
Clause 7	The IE is mandatory if "Intra-frequency event identity" is set to "1a" or "1c".

## 11.3 Information element definitions

```
IntraFreqMeasQuantity-FDD ::=          ENUMERATED {
                                         cpich-Ec-N0,
                                         cpich-RSCP,
                                         pathloss,
                                         ultra-CarrierRSSI }

-- If used in InterRATMeasQuantity only cpich-Ec-N0 and cpich-RSCP is
-- allowed.
-- If used in InterFreqMeasQuantity ultra-CarrierRSSI is not allowed.

IntraFreqMeasQuantity-TDD ::=          ENUMERATED {
                                         primaryCCPCH-RSCP,
                                         pathloss,
                                         timeslotISCP,
                                         ultra-CarrierRSSI }

-- If used in InterFreqMeasQuantity ultra-CarrierRSSI is not allowed.
```

### 13.4.27a TRIGGERED\_1A\_EVENTS

This variable contains information about [a 1a events](#) that hasve been triggered in the UE. [There is one such variable per 1a event configured in the UE.](#)

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Cells triggered	OP	1 to < maxCellMe as>		
>primary CPICH	MP		Primary CPICH info 10.3.6.60	
>sent reports	MP		Integer(1..Infinity)	Number of reports sent to UTRAN in case of event triggered periodical reporting
<u>Cells recently triggered</u>	<u>OP</u>	<u>1 to &lt; maxCellMe as&gt;</u>		
<u>&gt;primary CPICH</u>	<u>MP</u>		<u>Primary CPICH info 10.3.6.60</u>	
<u>&gt;sent reports</u>	<u>MP</u>		<u>Integer(1..Infinity)</u>	<u>Number of reports sent to UTRAN in case of event triggered periodical reporting</u>
<u>Periodical reporting running</u>	<u>MP</u>		<u>Boolean</u>	

### 13.4.27b TRIGGERED\_1B\_EVENTS

This variable contains information about [a 1b events](#) that hasve been triggered in the UE. [There is one such variable per 1b event configured in the UE.](#)

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Cells triggered	OP	1 to < maxCellMe as>		
>primary CPICH	MP		Primary CPICH info 10.3.6.60	
<u>Cells recently triggered</u>	<u>OP</u>	<u>1 to &lt; maxCellMe as&gt;</u>		
<u>&gt;primary CPICH</u>	<u>MP</u>		<u>Primary CPICH info 10.3.6.60</u>	

### 13.4.27c TRIGGERED\_1C\_EVENTS

This variable contains information about [a 1c events](#) that hasve been triggered in the UE. [There is one such variable per 1c event configured in the UE.](#)



Information Element/Group name	Need	Multi	Type and reference	Semantics description
Cells triggered	OP	1 to < maxCellMeas>		
>primary CPICH	MP		Primary CPICH info 10.3.6.60	
>sent reports	MP		Integer(1..Infinity)	Number of reports sent to UTRAN in case of event triggered periodical reporting
<u>Cells recently triggered</u>	<u>OP</u>	<u>1 to &lt; maxCellMeas&gt;</u>		
<u>&gt;primary CPICH</u>	<u>MP</u>		<u>Primary CPICH info 10.3.6.60</u>	
<u>&gt;sent reports</u>	<u>MP</u>		<u>Integer(1..Infinity)</u>	<u>Number of reports sent to UTRAN in case of event triggered periodical reporting</u>
<u>Periodical reporting running</u>	<u>MP</u>		<u>Boolean</u>	

### 13.4.27d BEST\_CELL\_1D\_EVENT

This variable contains information about a 1d events that hasve been triggered in the UE. There is one such variable per 1d event configured in the UE.

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Best cell	MP		Primary CPICH info 10.3.6.60	

### 13.4.27e TRIGGERED\_1E\_EVENTS

This variable contains information about a 1e events that hasve been triggered in the UE. There is one such variable per 1e event configured in the UE.

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Cells triggered	OP	1 to < maxCellMeas>		
>primary CPICH	MP		Primary CPICH info 10.3.6.60	
<u>Cells recently triggered</u>	<u>OP</u>	<u>1 to &lt; maxCellMeas&gt;</u>		
<u>&gt;primary CPICH</u>	<u>MP</u>		<u>Primary CPICH info 10.3.6.60</u>	

## 13.4.27f TRIGGERED\_1F\_EVENTS

This variable contains information about a 1f events that have been triggered in the UE. [There is one such variable per 1f event configured in the UE.](#)

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Cells triggered	OP	1 to <maxCellMeas>		
>primary CPICH	MP		Primary CPICH info 10.3.6.60	
<u>Cells recently triggered</u>	<u>OP</u>	<u>1 to &lt;maxCellMeas&gt;</u>		
<u>&gt;primary CPICH</u>	<u>MP</u>		<u>Primary CPICH info 10.3.6.60</u>	

## 14.1 Intra-frequency measurements

### 14.1.1 Intra-frequency measurement quantities

[A measurement quantity is used to evaluate whether an intra-frequency event has occurred or not. It can be:](#)

- 1 Downlink  $E_c/N_0$   $E_c/I_0$  (chip energy per total received channel power density).
- 2 Downlink path loss.

For FDD:

Pathloss in dB = Primary CPICH Tx power - CPICH RSCP.

For Primary CPICH Tx power the IE "Primary CPICH Tx power" shall be used. The unit is dBm.

CPICH RSCP is the result of the CPICH RSCP measurement. The unit is dBm.

For TDD:

Pathloss in dB = Primary CCPCH TX power - Primary CCPCH RSCP.

For Primary CCPCH TX power the IE "Primary CCPCH TX Power" shall be used. The unit is dBm.

Primary CCPCH RSCP is the result of the Primary CCPCH RSCP measurement. The unit is dBm.

If necessary Pathloss shall be rounded up to the next higher integer.

Results higher than 158 shall be reported as 158.

Results lower than 46 shall be reported as 46.

- 3 Downlink received signal code power (RSCP) after despreading.
- 4 ISCP measured on Timeslot basis.

[A description of those values can be found in \[7\] and \[8\].](#)

## 14.1.2 Intra-frequency reporting events for FDD

Within the measurement reporting criteria field in the Measurement Control message the UTRAN notifies the UE which events should trigger a measurement report. The listed events are the toolbox from which the UTRAN can choose the reporting events that are needed for the implemented handover evaluation function, or other radio network functions.

All the ~~illustrated-specified~~ events are measured with respect to any of the measurement quantities given in subclause 14.1.1. The measurement ~~objects~~ quantities are measured on ~~are~~ the monitored primary common pilot channels (CPICH) ~~of the cell defined in the measurement object~~.

Special mechanisms for the events are illustrated in section 14.1.4 and 14.1.5.

NOTE: The events below are numbered 1A, 1B, 1C,... since all intra-frequency reporting events would be labelled 1X, inter-frequency reporting events would be labelled 2X, and so on for the other measurement types.

### 14.1.2.1 Reporting event 1A: A Primary CPICH enters the reporting range

When event 1A is configured in the UE, the UE shall:

- if "Measurement quantity" is "pathloss" and Equation 1 below is fulfilled for one or more primary CPICHs, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 2 below is fulfilled for one or more primary CPICHs do the following for each of these primary CPICHs:
  - if the equations have been fulfilled during the time "Time to trigger", and if that primary CPICH is part of cells allowed to trigger the event according to "Triggering condition 2", and if that primary CPICH is not included in the "cells triggered" in the variable TRIGGERED\_1A\_EVENTS:
    - include that primary CPICH in the "cells recently triggered" in the variable TRIGGERED\_1A\_EVENTS;
- if the value of "Reporting deactivations threshold" for this event is greater than or equal to ~~than~~ the current number of cells in the active set or equal to 0 and any primary CPICHs are stored in the "cells recently triggered" in the variable TRIGGERED\_1A\_EVENT:
  - if "Reporting interval" for this event is not equal to 0:
    - if the IE "Periodical reporting running" in the variable TRIGGERED\_1A\_EVENT is set to FALSE
      - start a timer for that primary CPICH with the value of "Reporting interval" for this event and set the IE "Periodical reporting running" in the variable TRIGGERED\_1A\_EVENT to TRUE;
    - set "sent reports" for ~~that the~~ primary CPICHs in "cells recently triggered" in the variable TRIGGERED\_1A\_EVENTS to 1;
- send a measurement report with IEs set as below:
  - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1a" and in "cell measurement event results" the first entry to the IE "Primary CPICH info" of the primary CPICH that triggered the report; and

- ~~include this for each Ia event that is triggered without a report being sent; all entries of the "cells recently triggered" in the variable TRIGGERED\_1A\_EVENT that are not part of the active set in descending order according to the configured measurement quantity~~
- ~~the IE "measured results" and possible the IE "additional measured results" according to 8.4.2;~~
- ~~move all entries from "cells recently triggered" to "cells triggered" in the variable TRIGGERED\_1A\_EVENT~~
- if the timer for that primary CPICH in the variable TRIGGERED\_1A\_EVENT the periodical reporting has expired:
  - if ~~that any~~ primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1A\_EVENTS, and not included in the current active set:
    - if "Reporting interval" for this event is not equal to 0, and if "Reporting interval "Amount of reporting"" is greater larger than "sent reports" stored for ~~that any of these~~ primary CPICHs, in "cells triggered" in the variable TRIGGERED\_1A\_EVENTS; and
    - ~~and if the timer for that primary CPICH in the variable TRIGGERED\_1A\_EVENTS has expired:~~
      - increment the stored counter "sent reports" for ~~that all~~ CPICH in "cell triggered" in variable TRIGGERED\_1A\_EVENTS;
      - start a timer for that primary CPICH with the value of "Reporting interval" for this event;
      - send a measurement report with IEs set as below:
        - in "intra-frequency measurement event results": "Intrafrequency event identity" to "Ia" and in "cell measurement event results" ~~to the CPICH info of the primary CPICH that triggered the report; and;~~
          - include all entries of the variable TRIGGERED\_1A\_EVENT with value of IE "sent reports" smaller than value of "Amount of reporting" that are not part of the active set in descending order according to the configured measurement quantity ~~this for each Ia event that is triggered without a report being sent;~~
          - ~~increment the value of the IE "sent reports" for all entries in the variable TRIGGERED\_1A\_events~~
          - the IE "measured results" and possible the IE "additional measured results" according to 8.4.2;
          - ~~"sent reports" in variable TRIGGERED\_1A\_EVENT is greater than "Amount of reporting" for all entries~~
          - ~~set the IE "Periodical Reporting running" in the variable TRIGGERED\_1A\_EVENT to FALSE and disable the timer for the periodical reporting~~
- if "Measurement quantity" is "pathloss" and Equation 3 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 4 below is fulfilled for a primary CPICH:

- if that primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1A\_EVENTS:
- remove the entry of that primary CPICH and sent reports from "cells triggered" in the variable TRIGGERED\_1A\_EVENTS;
- if no entry in the variable TRIGGERED\_1A\_EVENT has a value of "sent reports" smaller than "Amount of reporting"
- stop the reporting interval timers related to that primary CPICH.
- set the IE "Periodical reporting running" in the variable TRIGGERED\_1A\_EVENT to FALSE

Upon transition to CELL\_DCH the UE shall:

- Include the primary CPICH of all cells in the current active set into the "cells triggered" in the variable TRIGGERED\_1A\_EVENTS.

Equation 1 (Triggering condition for pathloss)

$$10 \cdot \text{Log}M_{New} \leq W \cdot 10 \cdot \text{Log} \left( 1 / \sum_{i=1}^{N_A} (1/M_i) \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} + (R_{1a} - H_{1a} / 2),$$

Equation 2 (Triggering condition for all the other measurement quantities)

$$10 \cdot \text{Log}M_{New} \geq W \cdot 10 \cdot \text{Log} \left( \sum_{i=1}^{N_A} M_i \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} - (R_{1a} - H_{1a} / 2),$$

Equation 3 (Leaving triggering condition for pathloss)

$$10 \cdot \text{Log}M_{New} > W \cdot 10 \cdot \text{Log} \left( 1 / \sum_{i=1}^{N_A} (1/M_i) \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} + (R_{1a} + H_{1a} / 2), \text{ [}\geq \text{ in the formula changed to } > \text{]}$$

Equation 4 (Leaving triggering condition for all the other measurement quantities)

$$10 \cdot \text{Log}M_{New} < W \cdot 10 \cdot \text{Log} \left( \sum_{i=1}^{N_A} M_i \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} - (R_{1a} + H_{1a} / 2), \text{ [}\leq \text{ in the formula changed to } < \text{]}$$

The variables in the formula are defined as follows:

$M_{New}$  is the measurement result of the cell entering the reporting range.

$M_i$  is a measurement result of a cell in the active set.

$N_A$  is the number of cells in the current active set.

For pathloss

$M_{Best}$  is the measurement result of the cell in the active set with the lowest measurement result.

for other measurements quantities.

$M_{Best}$  is the measurement result of the cell in the active set with the highest measurement result.

$W$  is a parameter sent from UTRAN to UE.

$R_{1a}$  is the reporting range constant.

$H_{1a}$  is the hysteresis parameter for the event 1a.

If the measurement results are pathloss or CPICH-Ec/No then  $M_{New}$ ,  $M_i$  and  $M_{Best}$  are expressed as ratios.

If the measurement result is CPICH-RSCP then  $M_{New}$ ,  $M_i$  and  $M_{Best}$  are expressed in [mW].

The addition window of cells in event 1A is configured with the **reporting range constant** parameter ( $R_{1A}$ ) with an additional **hysteresis** parameter ( $H_{1A}$ ).

The occurrence of event 1A is conditional on a **report deactivation threshold** parameter.

Event 1A may be enhanced with an addition timer, which is configured with the **time-to-trigger** parameter (see subclause 14.1.5.2). If a time-to-trigger value is used, a cell must continuously stay within the reporting range for the given time period, before the UE shall send a measurement report.

Event 1A may be used for triggering a measurement report, which includes cells, which the UE has detected without having received a neighbour cell list.

If more than one cell triggers event 1A within the UE internal event evaluation period (defined in [19]) and fulfils the reporting criteria after the addition timer has elapsed, the UE shall report all of the triggering cells in the event results. The triggering cells shall be sorted in descending order according to the measured quantity.

#### 14.1.2.2 Reporting event 1B: A primary CPICH leaves the reporting range

When event 1B is configured in the UE, the UE shall:

- if "Measurement quantity" is "pathloss" and Equation 1 below is fulfilled for one or more primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 2 below is fulfilled for one or more primary CPICHs do the following for each of these primary CPICHs:
  - if the equations have been fulfilled during the time "Time to trigger", and if that primary CPICH is part of cells allowed to trigger the event according to "Triggering condition 1", and if that primary CPICH is not included in the "cells triggered" in the variable TRIGGERED\_1B\_EVENTS:
    - include that primary CPICH in the "cells recently triggered" in the variable TRIGGERED\_1B\_EVENTS;
- if any primary CPICHs are stored in the "cells recently triggered" in the variable TRIGGERED\_1B\_EVENT
  - send a measurement report with IEs set as below:
    - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1b" and "cell measurement event results" to the CPICH info of the primary CPICH that triggered the report; and
    - include all entries of "cells recently triggered" in the variable TRIGGERED\_1B\_EVENT that are part of the active set this for each 1b event that is triggered without a report being sent;
    - the IE "measured results" and possible the IE "additional measured results" according to 8.4.2.
    - move all entries from IE "cells recently triggered" to "cells triggered" in the variable TRIGGERED\_1B\_EVENT
- if "Measurement quantity" is "pathloss" and Equation 3 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 4 below is fulfilled for a primary CPICH:

- if that primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1B\_EVENTS;
- remove ~~the entry of~~ that primary CPICH ~~and sent reports~~ from "cells triggered" in the variable TRIGGERED\_1B\_EVENTS;

Equation 1 (Triggering condition for pathloss)

$$10 \cdot \text{Log}M_{Old} \geq W \cdot 10 \cdot \text{Log} \left( 1 / \sum_{i=1}^{N_A} (1/M_i) \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} + (R + H_{1b} / 2),$$

Equation 2 (Triggering condition for all the other measurement quantities)

$$10 \cdot \text{Log}M_{Old} \leq W \cdot 10 \cdot \text{Log} \left( \sum_{i=1}^{N_A} M_i \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} - (R + H_{1b} / 2),$$

Equation 3 (Leaving triggering condition for pathloss)

$$10 \cdot \text{Log}M_{Old} < W \cdot 10 \cdot \text{Log} \left( 1 / \sum_{i=1}^{N_A} (1/M_i) \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} + (R - H_{1b} / 2), \text{ [}\leq \text{ in the formula changed to } < \text{]}$$

Equation 4 (Leaving triggering condition for all the other measurement quantities)

$$10 \cdot \text{Log}M_{Old} > W \cdot 10 \cdot \text{Log} \left( \sum_{i=1}^{N_A} M_i \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} - (R - H_{1b} / 2), \text{ [}\geq \text{ in the formula changed to } > \text{]}$$

The variables in the formula are defined as follows:

$M_{Old}$  is the measurement result of the cell leaving the reporting range.

$M_i$  is a measurement result of a cell in the active set.

$N_A$  is the number of cells in the current active set.

For pathloss

$M_{Best}$  is the measurement result of the cell in the active set with the lowest measurement result.

for other measurements quantities.

$M_{Best}$  is the measurement result of the cell in the active set with the highest measurement result.

$W$  is a parameter sent from UTRAN to UE.

$R_{1b}$  is the reporting range constant.

$H_{1b}$  is the hysteresis parameter for the event 1b.

If the measurement results are pathloss or CPICH-Ec/No then  $M_{New}$ ,  $M_i$  and  $M_{Best}$  are expressed as ratios.

If the measurement result is CPICH-RSCP then  $M_{New}$ ,  $M_i$  and  $M_{Best}$  are expressed in [mW].

~~The drop window of cells in event 1B is configured with the reporting range constant parameter ( $R_{1b}$ ) with an additional hysteresis parameter ( $H_{1b}$ ).~~

~~Event 1B may be enhanced with a drop timer, which is configured with the time-to-trigger parameter. If the timer is used, the weakening cell must continuously stay below the reporting range for the given time period before the UE may send a measurement report.~~

~~If more than one cell triggers event 1B within the UE internal event evaluation period (defined in [19]) and fulfils the reporting criteria after the drop timer has elapsed, the UE shall report all of the triggering cells in the event results. The triggering cells shall be sorted in descending order according to the measured quantity.~~

### 14.1.2.3 Reporting event 1C: A non-active primary CPICH becomes better than an active primary CPICH

When event 1C is configured in the UE, the UE shall:

- if "Measurement quantity" is "pathloss" and Equation 1 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 2 below is fulfilled for one or more primary CPICH do the following for each of these primary CPICHs:
  - if the equations have been fulfilled during the time "Time to trigger", and if the primary CPICH that is better is not included in the active set but the other primary CPICH is any of the primary CPICHs included in the active set, and if that primary CPICH is not included in the "cells triggered" in the variable TRIGGERED\_1C\_EVENTS:
    - include that primary CPICH in the "cells recently triggered" in the variable TRIGGERED\_1C\_EVENTS;
- if the value of "Replacement activation threshold" for this event is less lower than or equal to the current number of cells in the active set or equal to 0 and if any primary CPICHs are stored in the "cells recently triggered" in the variable TRIGGERED\_1C\_EVENT:
  - if "Reporting interval" for this event is not equal to 0:
    - if the IE "Periodical reporting running" in the variable TRIGGERED\_1C\_EVENT is set to FALSE
      - start a timer for that primary CPICH with the value of "Reporting interval" for this event and set the IE "Periodical reporting running" in the variable TRIGGERED\_1C\_EVENT to TRUE;
    - set "sent reports" for that primary CPICH in the variable TRIGGERED\_1C\_EVENTS to 1;
  - send a measurement report with IEs set as below:
    - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1c" and in the first entry in "cell measurement event results":
      - to the IE "Primary CPICH info" of the primary CPICH all entries of the "cells recently triggered" in the variable TRIGGERED\_1C\_EVENT not in the active set as well as the "primary CPICH info" of the all the primary CPICHs in the active set for which the measured value is worse (i.e. greater for pathloss and less for the other measurement quantities) than the one of the entry in "cell recently triggered" that has the best measured value. The "primary CPICH info" shall be ordered according to their measured value from the best cell to the worst one. that triggered the report; and
      - the second entry in "cell measurement event results" to the CPICH info of the primary CPICH in the active set that now is worse than the new primary CPICH and has the best measured value (lowest measured result for pathloss and highest measured result for other measurements); and
      - the rest of the entries to other primary CPICHs that are now worse than this new primary CPICH in the order of their measured value;
    - the IE "measured results" and possible "additional measured results" according to 8.4.2;
  - move all entries from "cells recently triggered" to "cells triggered" in the variable TRIGGERED\_1C\_EVENT



- if the timer for the periodical reporting has expired:
  - if that any primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1C\_EVENTS, and not included in the current active set:
    - if "Reporting interval" for this event is not equal to 0, and if "Reporting interval" "Amount of reporting" is greater larger than "sent reports" stored for that primary CPICH, in "cells triggered" in the variable TRIGGERED\_1C\_EVENTS; and
      - if the timer for that primary CPICH in the variable TRIGGERED\_1C\_EVENTS has expired:
        - increment the stored counter "sent reports" for that all CPICH in "cell triggered" in variable TRIGGERED\_1C\_EVENTS;
        - start a timer for that primary CPICH with the value of "Reporting interval" for this event;
        - send a measurement report with IEs set as below:
          - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1c" and the first entry in "cell measurement event results":
            - to the CPICH info of the primary CPICH all entries of the variable TRIGGERED\_1C\_EVENT with value of IE "sent report" smaller than value of "Amount of reporting" and that are not part of in the active set as well as the "primary CPICH info" of the all the primary CPICHs in the active set for which the measured value is worse (i.e. greater for pathloss and less for the other measurement quantities) than the one of the entry in "cell recently triggered" that has the best measured value. The "primary CPICH info" shall be ordered according to their measured value from the best cell to the worst one. that triggered the report; and
              - the second entry in "cell measurement event results" to the CPICH info of the primary CPICH in the active set that now is worse than the new primary CPICH and has the best measured value (lowest measured result for pathloss and highest measured result for other measurements); and
                - the rest of the entries to other primary CPICHs that is now worse than this new primary CPICH in the order of their measured value;
            - the IE "measured results" and possible "additional measured results" according to 8.4.2;
  - if "sent reports" in variable TRIGGERED\_1C\_EVENT is greater than "Amount of reporting" for all entries
    - set the IE "Periodical Reporting running" in the variable TRIGGERED\_1C\_EVENT to FALSE and disable the timer for the periodical reporting
- if "Measurement quantity" is "pathloss" and Equation 3 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 4 below is fulfilled for a primary CPICH:
  - if that primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1C\_EVENTS:

- remove the entry of that primary CPICH and sent reports from "cells triggered" in the variable TRIGGERED\_1C\_EVENTS;
- if no entry in the variable TRIGGERED\_1C\_EVENT has a value of "sent reports" smaller than "Amount of reporting":
  - stop the reporting interval timers related to that primary CPICH.
  - Set the IE "Periodical reporting running" in the variable TRIGGERED\_1C\_EVENT to FALSE.

Equation 1 (Triggering condition for pathloss)

$$M_{New} \leq M_{InAS} - H_{1c} / 2$$

Equation 2 (Triggering condition for all the other measurement quantities)

$$M_{New} \geq M_{InAS} + H_{1c} / 2$$

Equation 3 (Leaving triggering condition for pathloss)

$$M_{New} > M_{InAS} + H_{1c} / 2, [\geq \text{in the formula changed to } >]$$

Equation 4 (Leaving triggering condition for all the other measurement quantities)

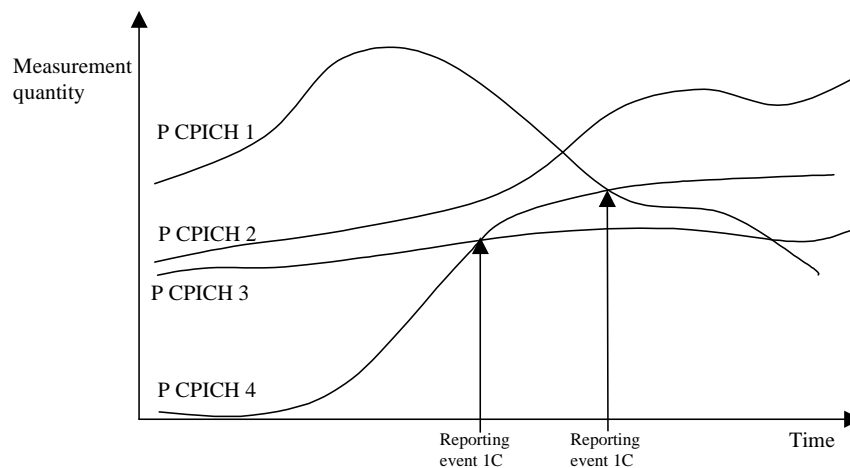
$$M_{New} < M_{InAS} - H_{1c} / 2, [ \leq \text{in the formula changed to } < ]$$

The variables in the formula are defined as follows:

$M_{New}$  is the measurement result of the cell not included in the active set.

$M_{InAS}$  is the measurement result of a cell in the active set.

$H_{1c}$  is the hysteresis parameter for the event 1c.



**Figure 63: A primary CPICH that is not included in the active set becomes better than a primary CPICH that is in the active set**

In this example the cells belonging to primary CPICH 1, 2 and 3 are supposed to be in the active set, but the cell transmitting primary CPICH 4 is not (yet) in the active set.

If a primary CPICH that is not included in the active set becomes better than a primary CPICH that is in the active set, and event 1C has been ordered by UTRAN, this event shall trigger a report to be sent from the UE.

This event may be used for replacing cells in the active set. It is activated if the number of active cells is equal to or greater than a **replacement activation threshold** parameter that UTRAN signals to the UE in the MEASUREMENT CONTROL message. This parameter indicates the minimum number of cells required in the active set for measurement reports triggered by event 1C to be transmitted.

#### 14.1.2.4 Reporting event 1D: Change of best cell

When event 1D is configured in the UE, the UE shall:

- if "Measurement quantity" is "pathloss" and Equation 1 below is fulfilled for a primary CPICH that is not stored in "Best cell" in variable BEST\_CELL\_1D\_EVENT, or if "Measurement quantity" is "CPICH Ec/NO" or "CPICH RSCP", and Equation 2 below is fulfilled for a primary CPICH that is not stored in "Best cell" in variable BEST\_CELL\_1D\_EVENT:
  - if the equations have been fulfilled during the time "Time to trigger":
    - set "best cell" in the variable BEST\_CELL\_1D\_EVENT to that primary CPICH that triggered the event;
    - send a measurement report with IEs set as below:
      - in "intra-frequency **measurement** event results"; "Intrafrequency event identity" to "1d" and "cell measurement event results" to the CPICH info of the primary CPICH that triggered the report.
      - **the IE** "measured results" and **possible the IE** "additional measured results" according to 8.4.2;

Upon transition to CELL\_DCH the UE shall:

- set "best cell" in the variable BEST\_CELL\_1D\_EVENT to the best cell of the primary CPICHs included in the active set.

Equation 1 (Triggering condition for pathloss)

$$M_{NotBest} \leq M_{Best} - H_{Id} / 2$$

Equation 2 (Triggering condition for all the other measurement quantities)

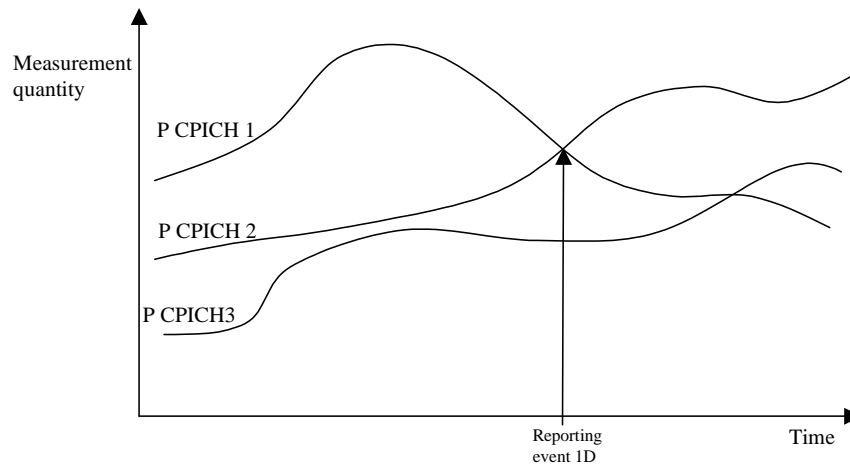
$$M_{NotBest} \geq M_{Best} + H_{Id} / 2$$

The variables in the formula are defined as follows:

$M_{NotBest}$  is the measurement result of a cell not stored in "best cell" in the variable BEST\_CELL\_1D\_EVENT.

$M_{Best}$  is the measurement result of the cell stored in "best cell" in variable BEST\_CELL\_1D\_EVENT.

$H_{Id}$  is the hysteresis parameter for the event 1d.



**Figure 64: A primary CPICH becomes better than the previously best primary CPICH**

#### 14.1.2.5 Reporting event 1E: A Primary CPICH becomes better than an absolute threshold

When event 1E is configured in the UE, the UE shall:

- if "Measurement quantity" is "pathloss" and Equation 1 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/NO" or "CPICH RSCP", and Equation 2 below is fulfilled for one or more primary CPICHs do the following for each of these primary CPICHs:
  - if the equations have been fulfilled during the time "Time to trigger", and if that primary CPICH is part of cells allowed to trigger the event according to "Triggering condition 2", and that primary CPICH is not included in the "cells triggered" in the variable TRIGGERED\_1E\_EVENTS:
    - include that primary CPICH in the "cells recently triggered" in the variable TRIGGERED\_1E\_EVENTS;
- if any primary CPICHs are stored in the "cells recently triggered" in the variable TRIGGERED\_1E\_EVENT
- send a measurement report with IEs set as below:
  - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1e" and in "cell measurement event results" to the CPICH info of the primary CPICH that triggered the report; and
  - all entries of the "cells recently triggered" in the variable TRIGGERED\_1E\_EVENT that are not part of the active set in descending order according to the configured measurement quantity - include this for each 1e event that is triggered without a report being sent;
  - the IE "measured results" and possible the IE "additional measured results" according to 8.4.2;
  - move all entries from "cells recently triggered" to "cells triggered" in the variable TRIGGERED\_1E\_EVENT

- if "Measurement quantity" is "pathloss" and Equation 3 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 4 below is fulfilled for a primary CPICH:
  - if that primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1E\_EVENTS:
    - remove that primary CPICH and sent reports from "cells triggered" in the variable TRIGGERED\_1E\_EVENTS.

Upon transition to CELL\_DCH the UE shall:

- include the primary CPICH of all cells in the current active set that fulfil the equations 1 or 2 according to the "Measurement quantity" of event 1e into the "cells triggered" in the variable TRIGGERED\_1E\_EVENTS.

Equation 1 (Triggering condition for pathloss)

$$M_{New} \leq T_{1e} - H_{1e} / 2$$

Equation 2 (Triggering condition for all the other measurement quantities)

$$M_{New} \geq T_{1e} + H_{1e} / 2$$

Equation 3 (Leaving triggering condition for pathloss)

$$M_{New} > T_{1e} + H_{1e} / 2, [\geq \text{in the formula changed to } >]$$

Equation 4 (Leaving triggering condition for all the other measurement quantities)

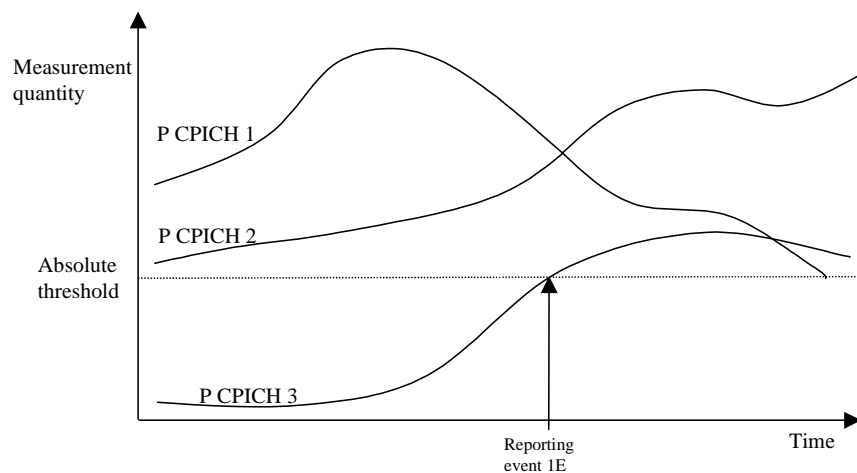
$$M_{New} < T_{1e} - H_{1e} / 2, [\leq \text{in the formula changed to } <]$$

The variables in the formula are defined as follows:

$M_{New}$  is the measurement result of a cell that becomes better than an absolute threshold.

$T_{1e}$  is an absolute threshold.

$H_{1e}$  is the hysteresis parameter for the event 1e.



**Figure 65: Event-triggered report when a Primary CPICH becomes better than an absolute threshold**

Event 1E may be used for triggering a measurement report, which includes cells, which the UE has detected without having received a neighbour cell list.

#### 14.1.2.6 Reporting event 1F: A Primary CPICH becomes worse than an absolute threshold

When event 1F is configured in the UE, the UE shall:

- if "Measurement quantity" is "pathloss" and Equation 1 below is fulfilled for one or more primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 2 below is fulfilled for one or more primary CPICHs do the following for each of these primary CPICHs:
  - if the equations have been fulfilled during the time "Time to trigger", and if that primary CPICH is part of cells allowed to trigger the event according to "Triggering condition 1", and that primary CPICH is not included in the "cells triggered" in the variable TRIGGERED\_1F\_EVENTS:
    - include that primary CPICH in the "cells recently triggered" in the variable TRIGGERED\_1F\_EVENTS;
- if any primary CPICHs are stored in the "cells recently triggered" in the variable TRIGGERED\_1F\_EVENT
  - send a measurement report with IEs set as below:
    - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1f" and in "cell measurement event results" ~~to all entries of the "cells recently triggered" in the variable TRIGGERED\_1F\_EVENT that are part of the active set in descending order according to the configured measurement quantity~~ the CPICH info of the primary CPICH that triggered the report; and
      - ~~include this for each 1f event that is triggered without a report being sent;~~
    - the IE "measured results" and ~~possible~~ "additional measured results" according to 8.4.2;
    - move all entries from "cells recently triggered" to "cells triggered" in the variable TRIGGERED\_1F\_EVENT
- if "Measurement quantity" is "pathloss" and Equation 3 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 4 below is fulfilled for a primary CPICH:
  - if that primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1F\_EVENTS:
    - remove that primary CPICH ~~and sent reports~~ from "cells triggered" in the variable TRIGGERED\_1F\_EVENTS.

Upon transition to CELL\_DCH the UE shall:

- include the primary CPICH of all cells that fulfil the equations 1 or 2 according to the "Measurement quantity" of event 1f into the "cells triggered" in the variable TRIGGERED\_1F\_EVENTS.

Equation 1 (Triggering condition for pathloss)

$$M_{New} \geq T_{f} + H_{f} / 2$$

Equation 2 (Triggering condition for all the other measurement quantities)

$$M_{New} \leq T_{If} - H_{If} / 2,$$

Equation 3 (Leaving triggering condition for pathloss)

$$M_{New} < T_{If} - H_{If} / 2, [\leq \text{in the formula changed to } <]$$

Equation 4 (Leaving triggering condition for all the other measurement quantities)

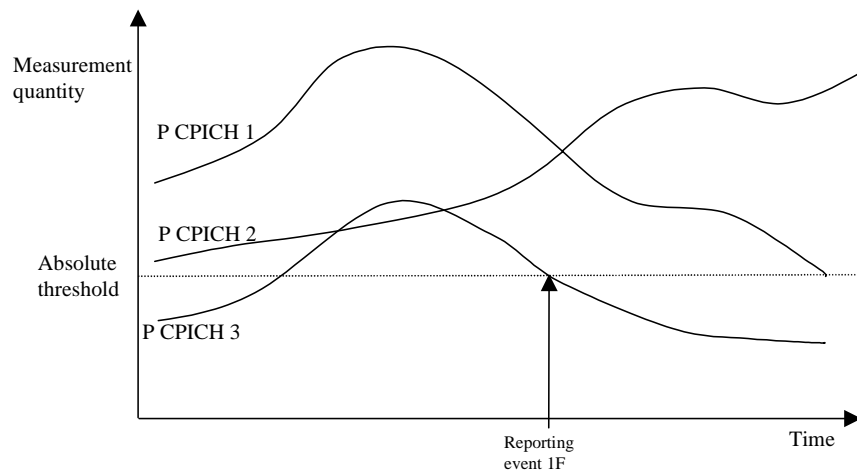
$$M_{New} > T_{If} + H_{If} / 2, [\geq \text{in the formula changed to } >]$$

The variables in the formula are defined as follows:

$M_{New}$  is the measurement result of a cell that becomes worse than an absolute threshold

$T_{If}$  is an absolute threshold

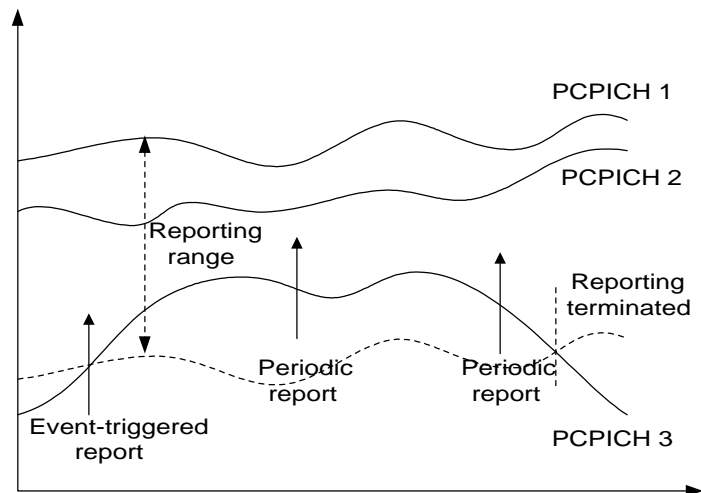
$H_{If}$  is the hysteresis parameter for the event 1f.



**Figure 66: Event-triggered report when a Primary CPICH becomes worse than an absolute threshold**

## 14.1.4 Event-triggered periodic intra-frequency measurement reports (informative)

### 14.1.4.1 Cell addition failure (FDD only)



**Figure 70: Periodic reporting triggered by event 1A**

When a cell enters the reporting range and triggers event 1A, the UE shall transmit a MEASUREMENT REPORT to the UTRAN and typically this may result in an update of the active set. However, in some situations the UTRAN may be unable to add a strong cell to the active set typically due to capacity shortage for example.

The UE shall continue reporting after the initial report by reverting to periodical measurement reporting if the reported cell is not added to the active set. This is illustrated in Figure 70. During periodic reporting the UE shall transmit MEASUREMENT REPORT messages to the UTRAN at predefined intervals. The reports shall include reporting information of the cells in the current active set and of the monitored cell(s) in the reporting range.

Event-triggered periodic measurement reporting shall be terminated if:

- there are no longer any monitored cell(s) within the reporting range; or
- the UTRAN has added cells to the active set so that it includes the maximum number of cells (defined by the **reporting deactivation threshold** parameter), which are allowed for event 1A to be triggered; or
- the UE has sent the maximum number of MEASUREMENT REPORT messages (defined by the **amount of reporting** parameter).

The reporting period is assigned by the UTRAN (with the **Reporting interval** parameter). If the reporting interval is set to zero event-triggered measurement reporting shall not be applied.



#### 14.1.4.2 Cell replacement failure (FDD only)

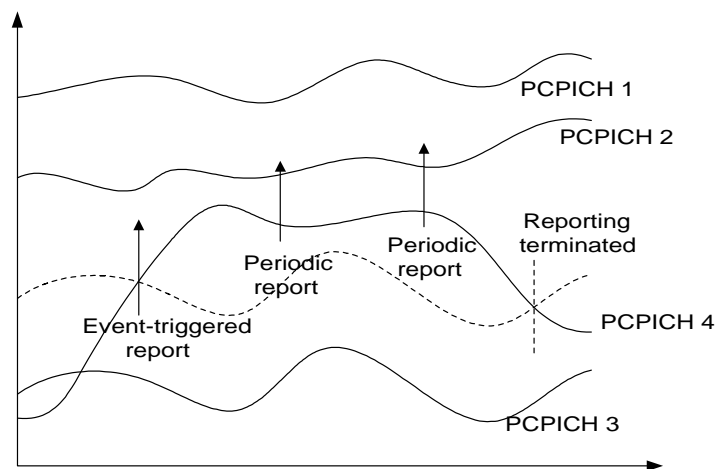


Figure 71: Periodic reporting triggered by event 1C

When a cell enters the replacement range and triggers event 1C, the UE shall transmit a MEASUREMENT REPORT to the UTRAN and typically this may result in the replacement of the weakest active cell. If the UTRAN is unable to replace the cell due to for example capacity shortage, it is beneficial to receive continuous reports in this case as well.

The UE shall revert to periodical measurement reporting if the UTRAN does not update the active set after the transmission of the measurement report. This is illustrated in Figure 71. During periodic reporting the UE shall transmit MEASUREMENT REPORT messages to the UTRAN at predefined intervals. The reports shall include reporting information of the cells in the current active set and of the monitored cell(s) in the replacement range.

Event-triggered periodic measurement reporting shall be terminated if:

- there are no longer any monitored cell(s) within the replacement range; or
- the UTRAN has removed cells from the active set so that there are no longer the minimum amount of active cells for event 1C to be triggered (as defined by the **replacement activation threshold** parameter); or
- the UE has sent the maximum number of MEASUREMENT REPORT messages (defined by the **amount of reporting** parameter).

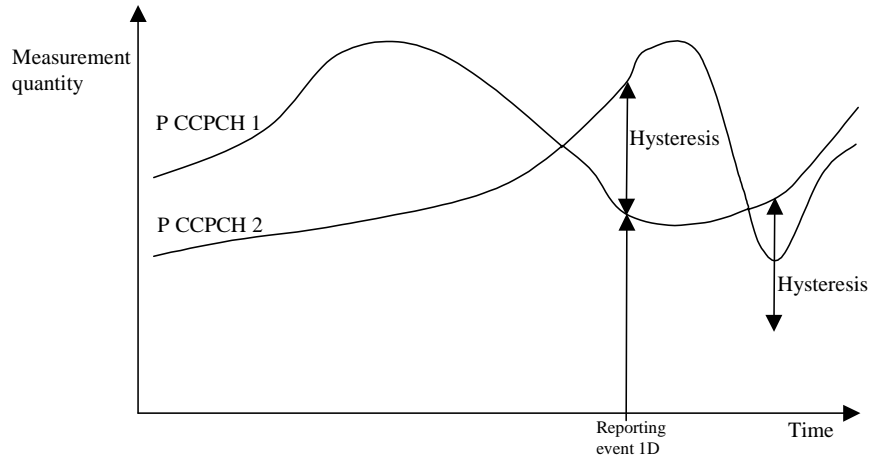
The reporting period is assigned by the UTRAN (with the **Reporting interval** parameter). If the reporting interval is set to zero, event-triggered measurement reporting shall not be applied.

### 14.1.5 Mechanisms available for modifying intra-frequency measurement reporting behaviour (informative)

#### 14.1.5.1 Hysteresis

To limit the amount of event-triggered reports, a hysteresis parameter may be connected with each reporting event given above. The value of the hysteresis is given to the UE in the Reporting criteria field of the Measurement Control message.

In the example in Figure 72, the hysteresis ensures that the event 1D (FDD) or IG(TDD) (primary CPICH(FDD)/CCPCH(TDD) 2 becomes the best cell) is not reported until the difference is equal to the hysteresis value. The fact that primary CPICH(FDD)/CCPCH(TDD) 1 becomes best afterwards is not reported at all in the example since the primary CPICH(FDD)/CCPCH(TDD) 1 does not become sufficiently better than the primary CPICH(FDD)/CCPCH(TDD) 2.

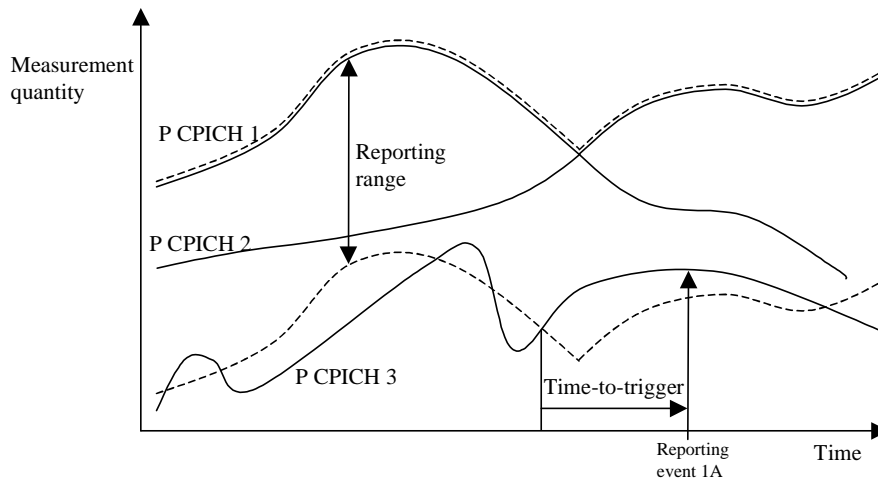


**Figure 72: Hysteresis limits the amount of measurement reports**

#### 14.1.5.2 Time-to-trigger

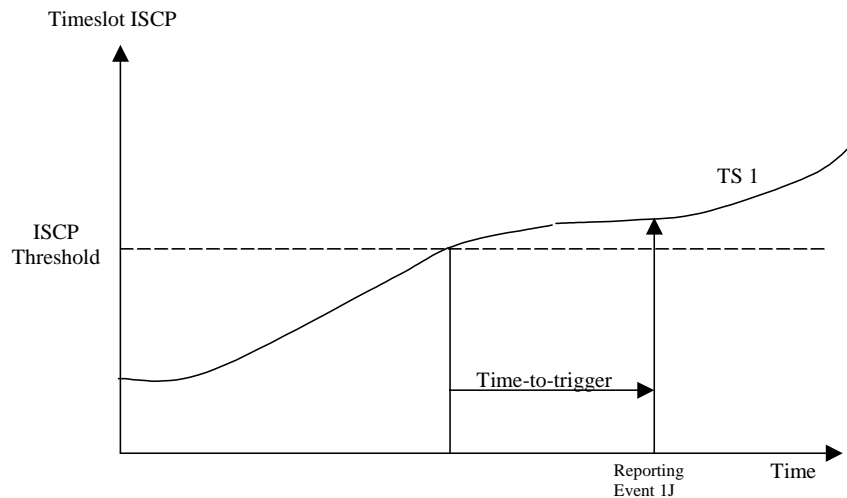
To limit the measurement signalling load, a time-to-trigger parameter could be connected with each reporting event given above. The value of the time-to-trigger is given to the UE in the Reporting criteria field of the Measurement Control message.

The effect of the time-to-trigger is that the report is triggered only after the conditions for the event have existed for the specified time-to-trigger. In the following FDD example in Figure 73, the use of time-to-trigger means that the event (primary CPICH 3 enters the reporting range) is not reported until it has been within the range for the time given by the time-to-trigger parameter.



**Figure 73: Time-to-trigger limits the amount of measurement reports**

In the following TDD example in Figure 74, the use of time-to-trigger means that the event (Timeslot ISCP upon certain threshold) is not reported until it has been upon the threshold for the time given by the time-to-trigger parameter.



**Figure 74: Time-to-trigger limits the amount of measurement reports**

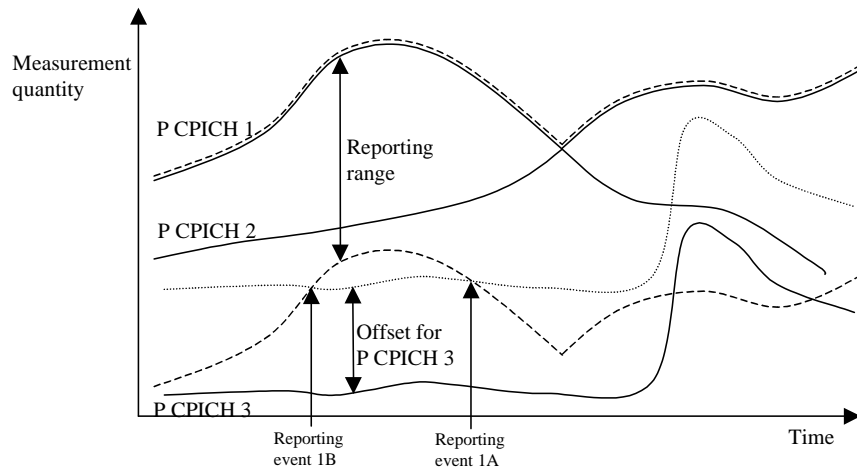
NOTE: The time-to-trigger could be combined with hysteresis, i.e. a hysteresis value is added to the measurement quantity before evaluating if the time-to-trigger timer should be started.

### 14.1.5.3 Cell individual offsets

For each cell that is monitored, an offset can be assigned with inband signalling. The offset can be either positive or negative. The offset is added to the measurement quantity before the UE evaluates if an event has occurred. The UE receives the cell individual offsets for each primary CPICH(FDD)/CCPCH(TDD) in the IE “Cell individual offset” included in the IE “Cell info” associated with each measurement object ~~field of included in~~ the MEASUREMENT CONTROL message.

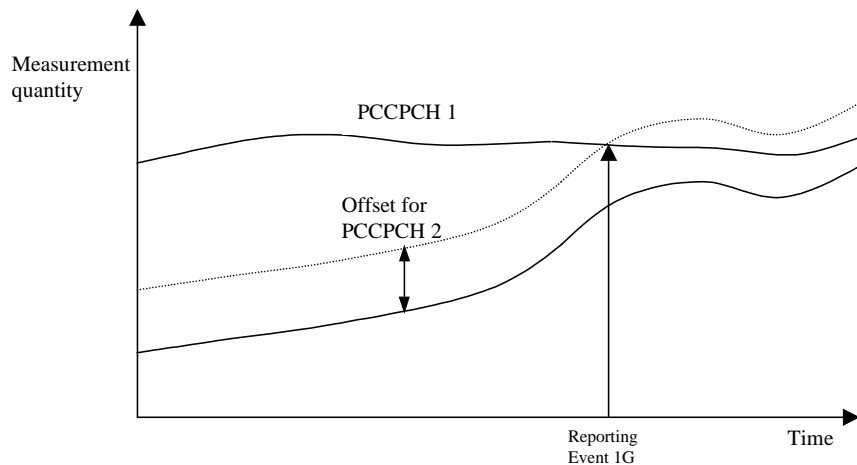
For the FDD example, in Figure 75, since an offset is added to primary CPICH 3, it is the dotted curve that is used to evaluate if an event occurs. Hence, this means that measurement reports from UE to UTRAN are triggered when primary CPICH plus the corresponding offset, i.e. the dotted curve, leaves and enters the reporting range and when it gets better than primary CPICH 1 (if these events have been ordered by UTRAN). This offset mechanism provides the network with an efficient tool to change the reporting of an individual primary CPICH.

By applying a positive offset, as in Figure 75, the UE will send measurement reports as if the primary CPICH is offset  $x$  dB better than what it really is. This could be useful if the operator knows that a specific cell is interesting to monitor more carefully, even though it is not so good for the moment. In the example in Figure 75, the operator might know by experience that in this area primary CPICH 3 can become good very quickly (e.g. due to street corners) and therefore that it is worth reporting more intensively. Depending on the implemented handover evaluation algorithm, this may result in the cell with primary CPICH 3 being included in the active set earlier than would have been the case without the positive offset.



**Figure 75: A positive offset is applied to primary CPICH 3 before event evaluation in the UE**

For the TDD example, in Figure 76, an offset is added to primary CCPCH2, it is the dotted curve that is used to evaluate if the primary CCPCH2 becomes better than primary CCPCH1 (ordered by the UTRAN).



**Figure 76: A positive offset is applied to primary CCPCH 2**

Correspondingly, the operator can choose to apply a negative offset to a primary CCPCH. Then the reporting on that primary CCPCH is limited and the corresponding cell may be, at least temporarily excluded from the active set or as a target cell for handover.

The cell individual offset can be seen as a tool to move the cell border. It is important to note that the offset is added before triggering events, i.e. the offset is added by the UE before evaluating if a measurement report should be sent as opposed to offsets that are applied in the network and used for the actual handover evaluation.

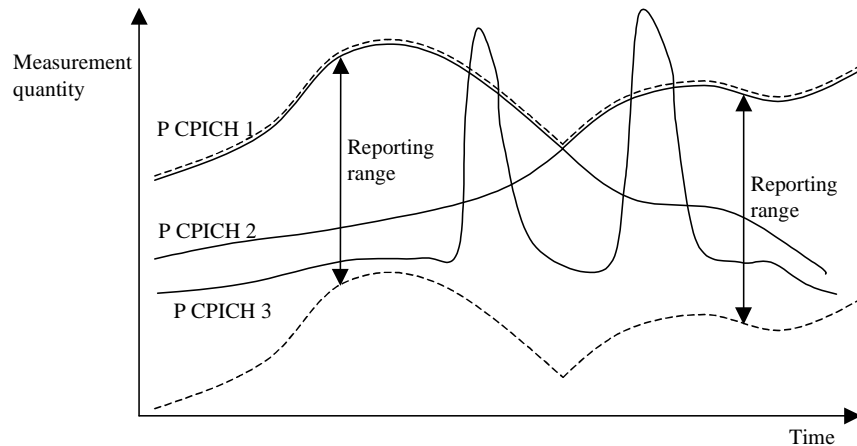
#### 14.1.5.4 Forbid a Primary CPICH to affect the reporting range (FDD only)

The reporting range affects the reporting events 1A and 1B presented above. The reporting range is defined as a function of all the Primary CPICHs in the active set (see 14.1.2.1 and 14.1.2.2). If the parameter W is set to 0, the reporting range is defined relative to the best Primary CPICH. However, there could be cases where it is good to forbid a specific Primary CPICH to affect the reporting range. For example in Figure 77 the network has requested the UE to not let Primary CPICH 3 affect the reporting range. This mechanism

could be effective if the operator knows by experience that the quality of Primary CPICH 3 is very unstable in a specific area and therefore should not affect the reporting of the other Primary CPICHs.

The UE shall ignore that a Primary CPICH is forbidden to affect the reporting range if all of the following conditions are fulfilled:

- the Primary CPICH is included in active set; and
- all cells in active set are defined as Primary CPICHs forbidden to affect the reporting range.



**Figure 77: Primary CPICH 3 is forbidden to affect the reporting range**

#### 14.1.6 Report quantities in intra-frequency measurements

The quantities that the UE shall report to UTRAN when the event is triggered for an intra-frequency measurement are given by the "Intra-frequency reporting quantity" IE stored for this measurement and can be the following:

- 1 SFN-SFN observed time difference
- 2 Cell synchronisation information
- 3 Cell Identity
- 4 Downlink  $E_c/N_0$  (FDD).
- 5 Downlink path loss.

For FDD:

Pathloss in dB = Primary CPICH Tx power - CPICH RSCP.

For Primary CPICH Tx power the IE "Primary CPICH Tx power" shall be used. The unit is dBm.

CPICH RSCP is the result of the CPICH RSCP measurement. The unit is dBm.

For TDD:

Pathloss in dB = Primary CCPCH TX power - Primary CCPCH RSCP.

For Primary CCPCH TX power the IE "Primary CCPCH TX Power" shall be used. The unit is dBm.

Primary CCPCH RSCP is the result of the Primary CCPCH RSCP measurement. The unit is dBm.

If necessary Pathloss shall be rounded up to the next higher integer.

Results higher than 158 shall be reported as 158.

Results lower than 46 shall be reported as 46.

- 5 Downlink received signal code power (RSCP) after despreading (of a primary CPICH for FDD, and of a primary CCPCH for TDD).
- 6 ISCP measured on Timeslot basis. (TDD)
- 7 Proposed TGSN (TDD)

A description of those values can be found in [7] and [8].

~~In the event triggered measurement reports, mandatory information connected to the events is always reported. For instance, at the event "a primary CPICH(FDD)/CCPCH(TDD) enters the reporting range" the corresponding report identifies the primary CPICH(FDD)/CCPCH(TDD) that entered the range. However, besides this mandatory information, UTRAN should be able to optionally require additional measurement information in the report to support the radio network functions in UTRAN. Furthermore, it will allow the UTRAN to use the UE as a general tool for radio network optimisation if necessary. Examples of report quantities that may be appended to the measurement reports are:~~

- ~~— Downlink transport channel block error rate.~~
- ~~— Downlink  $E_c/I_0$  on primary CPICH(FDD)/CCPCH(TDD) (e.g. used for initial DL power setting on new radio links).~~
- ~~— Time difference between the received primary CPICH(FDD)/CCPCH(TDD) frame timing from the target cell and the earliest received existing DPCH path. [Note: This measurement is identified in [26] (denoted  $T_m$  in clause 7)].~~
- ~~— UE transmit power.~~
- ~~— UE position.~~

## CHANGE REQUEST

⌘ **25.331 CR 926** ⌘ ev **r1** ⌘ Current version: **4.1.0** ⌘

For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.

**Proposed change affects:** ⌘ (U)SIM  ME/UE  Radio Access Network  Core Network

<b>Title:</b>	⌘ Intra-frequency measurement corrections		
<b>Source:</b>	⌘ TSG-RAN WG2		
<b>Work item code:</b>	⌘ TEI	<b>Date:</b>	⌘ 2001-09-14
<b>Category:</b>	⌘ <b>A</b>	<b>Release:</b>	⌘ REL-4
<i>Use <u>one</u> of the following categories:</i>		<i>Use <u>one</u> of the following releases:</i>	
<b>F</b> (correction)		2 (GSM Phase 2)	
<b>A</b> (corresponds to a correction in an earlier release)		R96 (Release 1996)	
<b>B</b> (addition of feature),		R97 (Release 1997)	
<b>C</b> (functional modification of feature)		R98 (Release 1998)	
<b>D</b> (editorial modification)		R99 (Release 1999)	
Detailed explanations of the above categories can be found in 3GPP <a href="#">TR 21.900</a> .		REL-4 (Release 4)	
		REL-5 (Release 5)	

<b>Reason for change:</b>	⌘ Some inconsistencies in the description of the events needed to be corrected. The use of the variables "TRIGGERED_1A_EVENT"... needed also to be clarified in case several 1a... events are configured.
<b>Summary of change:</b>	⌘ Introduction of new IE "Periodical Reporting running" in TRIGGERED_1A_EVENT and TRIGGERED_1C_EVENT to describe that during periodical reporting phase no further reports are to be sent due to trigger · Clarification on inclusion of elements in "intra-frequency measurement event results" · <a href="#">10.3.7.38</a> : UTRA carrier RSSI cannot be used as measurement quantity in any of the 1x events. It is therefore proposed not to allow for it to be specified as measurement quantity when configuring an intra-frequency measurement. · <a href="#">13.4.27a-13.4.27b</a> : it is clarified that there is one variable of type "TRIGGERED_1A_EVENT" per 1a event configured in the UE. The singular form was used instead of the plural in the names of the variables, since such a variable contains information related to one configured event. · <a href="#">14.1.1</a> : Ec/Io is said to be a measurement quantity, while in the tabular, as well as in <a href="#">25.215</a> , <a href="#">25.225</a> , Ec/No is the measurement quantity that is considered. The text is changed, and a reference to those two specifications is added regarding the description of the measurement quantities. · <a href="#">14.1.2.1</a> , <a href="#">14.1.2.2</a> , <a href="#">14.1.2.3</a> , <a href="#">14.1.2.5</a> , <a href="#">14.1.2.6</a> : in the leaving triggering conditions, the $\geq$ (resp. $\leq$ ) are changed to $>$ (resp. $<$ ), in order for those conditions to be the exact complementary of the triggering conditions. · <a href="#">14.1.2.1</a> and <a href="#">14.1.2.3</a> : at two places, it reads "reporting interval" where it should read "amount of reporting". This is corrected. Moreover, the text "if the value of "Reporting deactivations threshold" for this event is <b>greater than</b> the current number of cells in the active set or equal to 0" is changed to "if the value of "Reporting deactivations threshold"

	<p>for this event is <b>greater or equal to</b> the current number of cells in the active set or equal to 0” since otherwise the case where “Reporting deactivation threshold” is equal to 1 would not make sense.</p> <p>· <b>14.1.2.3:</b> it reads “if the value of "Replacement activation threshold" for this event is <b>lower</b> than the current number of cells in the active set or equal to 0". This is in contradiction with the text below the figure in the same section: “It is activated if the number of active cells is <b>equal to or greater than a replacement activation threshold</b> parameter that UTRAN signals to the UE in the MEASUREMENT CONTROL message”. A correction is proposed to make the text consistent.</p> <p>· <b>14.1.6:</b> the section is updated to reflect what are the values that can be reported by the UE in an intra-frequency measurement.</p> <p>This CR has an isolated impact on intra-frequency measurement reporting. Correction to a function where the specification was not sufficiently explicit. Would not affect implementations behaving like indicated in the CR, would affect implementations supporting the corrected functionality otherwise.</p>													
<b>Consequences if not approved:</b>	⌘	Inconsistencies in the text describing the 1x events.												
<b>Clauses affected:</b>	⌘	10.3.7.38, 10.3.7.39, 11.3, 13.4.27a, 13.4.27b, 13.4.27c, 13.4.27d, 13.4.27e, 13.4.27f, 14.1.1, 14.1.2, 14.1.2.1, 14.1.2.2, 14.1.2.3, 14.1.2.4, 14.1.2.5, 14.1.2.6, 14.1.4, 14.1.5, 14.1.5.3, 14.1.6												
<b>Other specs affected:</b>	⌘	<table border="0"> <tr> <td><input type="checkbox"/></td> <td>Other core specifications</td> <td>⌘</td> <td>25.331 v3.7.0, CR 0925r3</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Test specifications</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>O&amp;M Specifications</td> <td></td> <td></td> </tr> </table>	<input type="checkbox"/>	Other core specifications	⌘	25.331 v3.7.0, CR 0925r3	<input type="checkbox"/>	Test specifications			<input type="checkbox"/>	O&M Specifications		
<input type="checkbox"/>	Other core specifications	⌘	25.331 v3.7.0, CR 0925r3											
<input type="checkbox"/>	Test specifications													
<input type="checkbox"/>	O&M Specifications													
<b>Other comments:</b>	⌘													

### How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: [http://www.3gpp.org/3G\\_Specs/CRs.htm](http://www.3gpp.org/3G_Specs/CRs.htm). Below is a brief summary:

- 1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
- 2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under <ftp://ftp.3gpp.org/specs/> For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
- 3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.



### 10.3.7.38 Intra-frequency measurement quantity

The quantity the UE shall measure in case of intra-frequency measurement. It also includes the filtering of the measurements.

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Filter coefficient	MP		Filter coefficient 10.3.7.9	
CHOICE <i>mode</i>	MP			
>FDD				
>>Measurement quantity	MP		Enumerated(C PICH Ec/N0, CPICH RSCP, Pathloss, UTRA Carrier RSSI)	<del>If used in Inter-system measurement quantity only, Ec/N0 and RSCP is allowed. If used in inter-frequency mMeasurement quantity RSSI is not allowed in this release.</del>
>TDD				
>>Measurement quantity list	MP	1 to 4		
>>>Measurement quantity	MP		Enumerated(Pr imary CCPCH RSCP, Pathloss, Timeslot ISCP, UTRA Carrier RSSI)	<del>If used in inter-frequency measurement quantity RSSI is not allowed.</del>

### 10.3.7.39 Intra-frequency measurement reporting criteria

The triggering of the event-triggered reporting for an intra-frequency measurement. All events concerning intra-frequency measurements are labelled 1x where x is a, b, c....

Event 1a: A Primary CPICH enters the Reporting Range (FDD only).

Event 1b: A Primary CPICH leaves the Reporting Range (FDD only).

Event 1c: A Non-active Primary CPICH becomes better than an active Primary CPICH (FDD only).

Event 1d: Change of best cell ~~[Note 1]~~ (FDD only).

Event 1e: A Primary CPICH becomes better than an absolute threshold (FDD only).

Event 1f: A Primary CPICH becomes worse than an absolute threshold (FDD only).

Event 1g: Change of best cell in TDD.

Event 1h: Timeslot ISCP below a certain threshold (TDD only).

Event 1i: Timeslot ISCP above a certain threshold (TDD only).

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Parameters required for each event	OP	1 to <maxMeasEvent>		
>Intra-frequency event identity	MP		Intra-frequency event identity 10.3.7.34	
>Triggering condition 1	CV-clause 0		Enumerated(Active set cells, Monitored set cells, Active set cells and monitored set cells)	Indicates which cells can trigger the event
>Triggering condition 2	CV-clause 6		Enumerated(Active set cells, Monitored set cells, Active set cells and monitored set cells, Detected set cells, Detected set cells and monitored set cells)	Indicates which cells can trigger the event
>Reporting Range Constant	CV-clause 2		Real(0..14.5 by step of 0.5)	In dB. In event 1a,1b.
>Cells forbidden to affect Reporting range	CV-clause 1	1 to <maxCellMeas>		In event 1a,1b
>>CHOICE mode	MP			
>>>FDD				
>>>>Primary CPICH info	MP		Primary CPICH info 10.3.6.60	
>>>TDD				
>>>>Primary CCPCH info	MP		Primary CCPCH info 10.3.6.57	
>W	CV-clause 2		Real(0.0..2.0 by step of 0.1)	
>Hysteresis	MP		Real(0..7.5 by step of 0.5)	In dB.
>Threshold used frequency	CV-clause 3		Integer (-115..165)	Range used depend on measurement quantity. CPICH RSCP -115..-25 dBm CPICH Ec/No -24..0 dB Pathloss 30..165dB ISCP -115..-25 dBm

Information Element/Group name	Need	Multi	Type and reference	Semantics description
>Reporting deactivation threshold	CV-clause 4		Integer(0, 1, 2, 3, 4, 5, 6, 7)	In event 1a Indicates the maximum number of cells allowed in the active set in order for event 1a to occur. 0 means not applicable
>Replacement activation threshold	CV-clause 5		Integer(0, 1, 2, 3, 4, 5, 6, 7)	In event 1c Indicates the minimum number of cells allowed in the active set in order for event 1c to occur. 0 means not applicable
>Time to trigger	MP		Time to trigger 10.3.7.64	Indicates the period of time between the timing of event detection and the timing of sending Measurement Report. Time in ms
>Amount of reporting	CV-clause 7		Integer(1, 2, 4, 8, 16, 32, 64, Infinity)	
>Reporting interval	CV-clause 7		Integer(0, 250, 500, 1000, 2000, 4000, 8000, 16000)	Indicates the interval of periodical reporting when such reporting is triggered by an event. Interval in milliseconds. 0 means no periodical reporting
>Reporting cell status	OP		Reporting cell status 10.3.7.61	

Condition	Explanation
Clause 0	The IE is mandatory if "Intra-frequency event identity" is set to "1b" or "1f", otherwise the IE is not needed
Clause 1	The IE is optional if "Intra-frequency event identity" is set to "1a" or "1b", otherwise the IE is not needed
Clause 2	The IE is mandatory if "Intra-frequency event identity" is set to "1a" or "1b", otherwise the IE is not needed
Clause 3	The IE is mandatory if "Intra-frequency event identity" is set to , "1e", "1f", "1h" or "1i", otherwise the IE is not needed
Clause 4	The IE is mandatory if "Intra-frequency event identity" is set to "1a", otherwise the IE is not needed
Clause 5	The IE is mandatory if "Intra-frequency event identity" is set to "1c", otherwise the IE is not needed
Clause 6	The IE is mandatory if "Intra-frequency event identity" is set to "1a" or "1e".
Clause 7	The IE is mandatory if "Intra-frequency event identity" is set to "1a" or "1c".

## 11.3 Information element definitions

```
IntraFreqMeasQuantity-FDD ::=          ENUMERATED {
                                         cpich-Ec-N0,
                                         cpich-RSCP,
                                         pathloss,
                                         ultra-CarrierRSSI }

-- If used in InterRATMeasQuantity only cpich-Ec-N0 and cpich-RSCP is
-- allowed.
-- If used in InterFreqMeasQuantity ultra-CarrierRSSI is not allowed.

IntraFreqMeasQuantity-TDD ::=          ENUMERATED {
                                         primaryCCPCH-RSCP,
                                         pathloss,
                                         timeslotISCP,
                                         ultra-CarrierRSSI }

-- If used in InterFreqMeasQuantity ultra-CarrierRSSI is not allowed.
```

### 13.4.27a TRIGGERED\_1A\_EVENTS

This variable contains information about [a 1a events](#) that hasve been triggered in the UE. [There is one such variable per 1a event configured in the UE.](#)

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Cells triggered	OP	1 to < maxCellMe as>		
>primary CPICH	MP		Primary CPICH info 10.3.6.60	
>sent reports	MP		Integer(1..Infinity)	Number of reports sent to UTRAN in case of event triggered periodical reporting
<u>Cells recently triggered</u>	<u>OP</u>	<u>1 to &lt; maxCellMe as&gt;</u>		
<u>&gt;primary CPICH</u>	<u>MP</u>		<u>Primary CPICH info 10.3.6.60</u>	
<u>&gt;sent reports</u>	<u>MP</u>		<u>Integer(1..Infinity)</u>	<u>Number of reports sent to UTRAN in case of event triggered periodical reporting</u>
<u>Periodical reporting running</u>	<u>MP</u>		<u>Boolean</u>	

### 13.4.27b TRIGGERED\_1B\_EVENTS

This variable contains information about [a 1b events](#) that hasve been triggered in the UE. [There is one such variable per 1b event configured in the UE.](#)

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Cells triggered	OP	1 to < maxCellMe as>		
>primary CPICH	MP		Primary CPICH info 10.3.6.60	
<u>Cells recently triggered</u>	<u>OP</u>	<u>1 to &lt; maxCellMe as&gt;</u>		
<u>&gt;primary CPICH</u>	<u>MP</u>		<u>Primary CPICH info 10.3.6.60</u>	

### 13.4.27c TRIGGERED\_1C\_EVENTS

This variable contains information about [a 1c events](#) that hasve been triggered in the UE. [There is one such variable per 1c event configured in the UE.](#)

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Cells triggered	OP	1 to < maxCellMeas>		
>primary CPICH	MP		Primary CPICH info 10.3.6.60	
>sent reports	MP		Integer(1..Infinity)	Number of reports sent to UTRAN in case of event triggered periodical reporting
<u>Cells recently triggered</u>	<u>OP</u>	<u>1 to &lt; maxCellMeas&gt;</u>		
<u>&gt;primary CPICH</u>	<u>MP</u>		<u>Primary CPICH info 10.3.6.60</u>	
<u>&gt;sent reports</u>	<u>MP</u>		<u>Integer(1..Infinity)</u>	<u>Number of reports sent to UTRAN in case of event triggered periodical reporting</u>
<u>Periodical reporting running</u>	<u>MP</u>		<u>Boolean</u>	

### 13.4.27d BEST\_CELL\_1D\_EVENT

This variable contains information about a 1d events that hasve been triggered in the UE. There is one such variable per 1d event configured in the UE.

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Best cell	MP		Primary CPICH info 10.3.6.60	

### 13.4.27e TRIGGERED\_1E\_EVENTS

This variable contains information about a 1e events that hasve been triggered in the UE. There is one such variable per 1e event configured in the UE.

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Cells triggered	OP	1 to < maxCellMeas>		
>primary CPICH	MP		Primary CPICH info 10.3.6.60	
<u>Cells recently triggered</u>	<u>OP</u>	<u>1 to &lt; maxCellMeas&gt;</u>		
<u>&gt;primary CPICH</u>	<u>MP</u>		<u>Primary CPICH info 10.3.6.60</u>	

## 13.4.27f TRIGGERED\_1F\_EVENTS

This variable contains information about a 1f events that have been triggered in the UE. [There is one such variable per 1f event configured in the UE.](#)

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Cells triggered	OP	1 to <maxCellMeas>		
>primary CPICH	MP		Primary CPICH info 10.3.6.60	
<u>Cells recently triggered</u>	<u>OP</u>	<u>1 to &lt;maxCellMeas&gt;</u>		
<u>&gt;primary CPICH</u>	<u>MP</u>		<u>Primary CPICH info 10.3.6.60</u>	

## 14.1 Intra-frequency measurements

### 14.1.1 Intra-frequency measurement quantities

[A measurement quantity is used to evaluate whether an intra-frequency event has occurred or not. It can be:](#)

- 1 Downlink  $E_c/N_0$   $E_c/I_0$  (chip energy per total received channel power density).
- 2 Downlink path loss.

For FDD:

Pathloss in dB = Primary CPICH Tx power - CPICH RSCP.

For Primary CPICH Tx power the IE "Primary CPICH Tx power" shall be used. The unit is dBm.

CPICH RSCP is the result of the CPICH RSCP measurement. The unit is dBm.

For TDD:

Pathloss in dB = Primary CCPCH TX power - Primary CCPCH RSCP.

For Primary CCPCH TX power the IE "Primary CCPCH TX Power" shall be used. The unit is dBm.

Primary CCPCH RSCP is the result of the Primary CCPCH RSCP measurement. The unit is dBm.

If necessary Pathloss shall be rounded up to the next higher integer.

Results higher than 158 shall be reported as 158.

Results lower than 46 shall be reported as 46.

- 3 Downlink received signal code power (RSCP) after despreading.
- 4 ISCP measured on Timeslot basis.

[A description of those values can be found in \[7\] and \[8\].](#)

## 14.1.2 Intra-frequency reporting events for FDD

Within the measurement reporting criteria field in the Measurement Control message the UTRAN notifies the UE which events should trigger a measurement report. The listed events are the toolbox from which the UTRAN can choose the reporting events that are needed for the implemented handover evaluation function, or other radio network functions.

All the ~~illustrated-specified~~ events are measured with respect to any of the measurement quantities given in subclause 14.1.1. The measurement ~~objects~~ quantities are measured on ~~are~~ the monitored primary common pilot channels (CPICH) of the cell defined in the measurement object.

Special mechanisms for the events are illustrated in section 14.1.4 and 14.1.5.

NOTE: The events below are numbered 1A, 1B, 1C,... since all intra-frequency reporting events would be labelled 1X, inter-frequency reporting events would be labelled 2X, and so on for the other measurement types.

### 14.1.2.1 Reporting event 1A: A Primary CPICH enters the reporting range

When event 1A is configured in the UE, the UE shall:

- if "Measurement quantity" is "pathloss" and Equation 1 below is fulfilled for one or more primary CPICHs, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 2 below is fulfilled for one or more primary CPICHs do the following for each of these primary CPICHs:
  - if the equations have been fulfilled during the time "Time to trigger", and if that primary CPICH is part of cells allowed to trigger the event according to "Triggering condition 2", and if that primary CPICH is not included in the "cells triggered" in the variable TRIGGERED\_1A\_EVENTS:
    - include that primary CPICH in the "cells recently triggered" in the variable TRIGGERED\_1A\_EVENTS;
- if the value of "Reporting deactivations threshold" for this event is greater than or equal to ~~than~~ the current number of cells in the active set or equal to 0 and any primary CPICHs are stored in the "cells recently triggered" in the variable TRIGGERED\_1A\_EVENT:
  - if "Reporting interval" for this event is not equal to 0:
    - if the IE "Periodical reporting running" in the variable TRIGGERED\_1A\_EVENT is set to FALSE
      - start a timer for that primary CPICH with the value of "Reporting interval" for this event and set the IE "Periodical reporting running" in the variable TRIGGERED\_1A\_EVENT to TRUE;
    - set "sent reports" for ~~that the~~ primary CPICHs in "cells recently triggered" in the variable TRIGGERED\_1A\_EVENTS to 1;
- send a measurement report with IEs set as below:
  - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1a" and in "cell measurement event results" the first entry to the IE "Primary CPICH info" of the primary CPICH that triggered the report; and



- ~~include this for each 1a event that is triggered without a report being sent; all entries of the "cells recently triggered" in the variable TRIGGERED\_1A\_EVENT that are not part of the active set in descending order according to the configured measurement quantity~~
- ~~the IE "measured results" and possible the IE "additional measured results" according to 8.4.2;~~
- ~~move all entries from "cells recently triggered" to "cells triggered" in the variable TRIGGERED\_1A\_EVENT~~
- if the timer for that primary CPICH in the variable TRIGGERED\_1A\_EVENT the periodical reporting has expired:
  - if ~~that any~~ primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1A\_EVENTS, and not included in the current active set:
    - if "Reporting interval" for this event is not equal to 0, and if "Reporting interval "Amount of reporting" is greater larger than "sent reports" stored for ~~that any of these~~ primary CPICHs, in "cells triggered" in the variable TRIGGERED\_1A\_EVENTS; and
    - ~~and if the timer for that primary CPICH in the variable TRIGGERED\_1A\_EVENTS has expired:~~
      - increment the stored counter "sent reports" for ~~that all~~ CPICH in "cell triggered" in variable TRIGGERED\_1A\_EVENTS;
      - start a timer for that primary CPICH with the value of "Reporting interval" for this event;
      - send a measurement report with IEs set as below:
        - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1a" and in "cell measurement event results" to the CPICH info of the primary CPICH that triggered the report; and;
          - include all entries of the variable TRIGGERED\_1A\_EVENT with value of IE "sent reports" smaller than value of "Amount of reporting" that are not part of the active set in descending order according to the configured measurement quantity ~~this for each 1a event that is triggered without a report being sent;~~
          - ~~increment the value of the IE "sent reports" for all entries in the variable TRIGGERED\_1A\_EVENTS~~
          - the IE "measured results" and possible the IE "additional measured results" according to 8.4.2;
          - ~~"sent reports" in variable TRIGGERED\_1A\_EVENT is greater than "Amount of reporting" for all entries~~
          - ~~set the IE "Periodical Reporting running" in the variable TRIGGERED\_1A\_EVENT to FALSE and disable the timer for the periodical reporting~~
- if "Measurement quantity" is "pathloss" and Equation 3 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 4 below is fulfilled for a primary CPICH:

- if that primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1A\_EVENTS:
- remove the entry of that primary CPICH and sent reports from "cells triggered" in the variable TRIGGERED\_1A\_EVENTS;
- if no entry in the variable TRIGGERED\_1A\_EVENT has a value of "sent reports" smaller than "Amount of reporting"
- stop the reporting interval timers related to that primary CPICH.
- set the IE "Periodical reporting running" in the variable TRIGGERED\_1A\_EVENT to FALSE

Upon transition to CELL\_DCH the UE shall:

- Include the primary CPICH of all cells in the current active set into the "cells triggered" in the variable TRIGGERED\_1A\_EVENTS.

Equation 1 (Triggering condition for pathloss)

$$10 \cdot \text{Log}M_{New} \leq W \cdot 10 \cdot \text{Log} \left( 1 / \sum_{i=1}^{N_A} (1/M_i) \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} + (R_{1a} - H_{1a} / 2),$$

Equation 2 (Triggering condition for all the other measurement quantities)

$$10 \cdot \text{Log}M_{New} \geq W \cdot 10 \cdot \text{Log} \left( \sum_{i=1}^{N_A} M_i \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} - (R_{1a} - H_{1a} / 2),$$

Equation 3 (Leaving triggering condition for pathloss)

$$10 \cdot \text{Log}M_{New} > W \cdot 10 \cdot \text{Log} \left( 1 / \sum_{i=1}^{N_A} (1/M_i) \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} + (R_{1a} + H_{1a} / 2), \text{ [}\geq \text{ in the formula changed to } > \text{]}$$

Equation 4 (Leaving triggering condition for all the other measurement quantities)

$$10 \cdot \text{Log}M_{New} < W \cdot 10 \cdot \text{Log} \left( \sum_{i=1}^{N_A} M_i \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} - (R_{1a} + H_{1a} / 2), \text{ [}\leq \text{ in the formula changed to } < \text{]}$$

The variables in the formula are defined as follows:

$M_{New}$  is the measurement result of the cell entering the reporting range.

$M_i$  is a measurement result of a cell in the active set.

$N_A$  is the number of cells in the current active set.

For pathloss

$M_{Best}$  is the measurement result of the cell in the active set with the lowest measurement result.

for other measurements quantities.

$M_{Best}$  is the measurement result of the cell in the active set with the highest measurement result.

$W$  is a parameter sent from UTRAN to UE.

$R_{1a}$  is the reporting range constant.

$H_{1a}$  is the hysteresis parameter for the event 1a.

If the measurement results are pathloss or CPICH-Ec/No then  $M_{New}$ ,  $M_i$  and  $M_{Best}$  are expressed as ratios.

If the measurement result is CPICH-RSCP then  $M_{New}$ ,  $M_i$  and  $M_{Best}$  are expressed in [mW].

The addition window of cells in event 1A is configured with the **reporting range constant** parameter ( $R_{1A}$ ) with an additional **hysteresis** parameter ( $H_{1A}$ ).

The occurrence of event 1A is conditional on a **report deactivation threshold** parameter.

Event 1A may be enhanced with an addition timer, which is configured with the **time-to-trigger** parameter (see subclause 14.1.5.2). If a time-to-trigger value is used, a cell must continuously stay within the reporting range for the given time period, before the UE shall send a measurement report.

Event 1A may be used for triggering a measurement report, which includes cells, which the UE has detected without having received a neighbour cell list.

If more than one cell triggers event 1A within the UE internal event evaluation period (defined in [19]) and fulfils the reporting criteria after the addition timer has elapsed, the UE shall report all of the triggering cells in the event results. The triggering cells shall be sorted in descending order according to the measured quantity.

#### 14.1.2.2 Reporting event 1B: A primary CPICH leaves the reporting range

When event 1B is configured in the UE, the UE shall:

- if "Measurement quantity" is "pathloss" and Equation 1 below is fulfilled for one or more primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 2 below is fulfilled for one or more primary CPICHs do the following for each of these primary CPICHs:
  - if the equations have been fulfilled during the time "Time to trigger", and if that primary CPICH is part of cells allowed to trigger the event according to "Triggering condition 1", and if that primary CPICH is not included in the "cells triggered" in the variable TRIGGERED\_1B\_EVENTS:
    - include that primary CPICH in the "cells recently triggered" in the variable TRIGGERED\_1B\_EVENTS;
- if any primary CPICHs are stored in the "cells recently triggered" in the variable TRIGGERED\_1B\_EVENT
  - send a measurement report with IEs set as below:
    - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1b" and "cell measurement event results" to the CPICH info of the primary CPICH that triggered the report; and
    - include all entries of "cells recently triggered" in the variable TRIGGERED\_1B\_EVENT that are part of the active set this for each 1b event that is triggered without a report being sent;
    - the IE "measured results" and possible the IE "additional measured results" according to 8.4.2.
    - move all entries from IE "cells recently triggered" to "cells triggered" in the variable TRIGGERED\_1B\_EVENT
- if "Measurement quantity" is "pathloss" and Equation 3 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 4 below is fulfilled for a primary CPICH:

- if that primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1B\_EVENTS;
- remove ~~the entry of~~ that primary CPICH ~~and sent reports~~ from "cells triggered" in the variable TRIGGERED\_1B\_EVENTS;

Equation 1 (Triggering condition for pathloss)

$$10 \cdot \text{Log}M_{Old} \geq W \cdot 10 \cdot \text{Log} \left( 1 / \sum_{i=1}^{N_A} (1/M_i) \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} + (R + H_{1b} / 2),$$

Equation 2 (Triggering condition for all the other measurement quantities)

$$10 \cdot \text{Log}M_{Old} \leq W \cdot 10 \cdot \text{Log} \left( \sum_{i=1}^{N_A} M_i \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} - (R + H_{1b} / 2),$$

Equation 3 (Leaving triggering condition for pathloss)

$$10 \cdot \text{Log}M_{Old} < W \cdot 10 \cdot \text{Log} \left( 1 / \sum_{i=1}^{N_A} (1/M_i) \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} + (R - H_{1b} / 2), \text{ [}\leq \text{ in the formula changed to } < \text{]}$$

Equation 4 (Leaving triggering condition for all the other measurement quantities)

$$10 \cdot \text{Log}M_{Old} > W \cdot 10 \cdot \text{Log} \left( \sum_{i=1}^{N_A} M_i \right) + (1-W) \cdot 10 \cdot \text{Log}M_{Best} - (R - H_{1b} / 2), \text{ [}\geq \text{ in the formula changed to } > \text{]}$$

The variables in the formula are defined as follows:

$M_{Old}$  is the measurement result of the cell leaving the reporting range.

$M_i$  is a measurement result of a cell in the active set.

$N_A$  is the number of cells in the current active set.

For pathloss

$M_{Best}$  is the measurement result of the cell in the active set with the lowest measurement result.

for other measurements quantities.

$M_{Best}$  is the measurement result of the cell in the active set with the highest measurement result.

$W$  is a parameter sent from UTRAN to UE.

$R_{1b}$  is the reporting range constant.

$H_{1b}$  is the hysteresis parameter for the event 1b.

If the measurement results are pathloss or CPICH-Ec/No then  $M_{New}$ ,  $M_i$  and  $M_{Best}$  are expressed as ratios.

If the measurement result is CPICH-RSCP then  $M_{New}$ ,  $M_i$  and  $M_{Best}$  are expressed in [mW].

~~The drop window of cells in event 1B is configured with the reporting range constant parameter ( $R_{1b}$ ) with an additional hysteresis parameter ( $H_{1b}$ ).~~

~~Event 1B may be enhanced with a drop timer, which is configured with the time-to-trigger parameter. If the timer is used, the weakening cell must continuously stay below the reporting range for the given time period before the UE may send a measurement report.~~

~~If more than one cell triggers event 1B within the UE internal event evaluation period (defined in [19]) and fulfils the reporting criteria after the drop timer has elapsed, the UE shall report all of the triggering cells in the event results. The triggering cells shall be sorted in descending order according to the measured quantity.~~

### 14.1.2.3 Reporting event 1C: A non-active primary CPICH becomes better than an active primary CPICH

When event 1C is configured in the UE, the UE shall:

- if "Measurement quantity" is "pathloss" and Equation 1 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 2 below is fulfilled for one or more primary CPICH do the following for each of these primary CPICHs:
  - if the equations have been fulfilled during the time "Time to trigger", and if the primary CPICH that is better is not included in the active set but the other primary CPICH is any of the primary CPICHs included in the active set, and if that primary CPICH is not included in the "cells triggered" in the variable TRIGGERED\_1C\_EVENTS:
    - include that primary CPICH in the "cells recently triggered" in the variable TRIGGERED\_1C\_EVENTS;
- if the value of "Replacement activation threshold" for this event is less lower than or equal to the current number of cells in the active set or equal to 0 and if any primary CPICHs are stored in the "cells recently triggered" in the variable TRIGGERED\_1C\_EVENT:
  - if "Reporting interval" for this event is not equal to 0:
    - if the IE "Periodical reporting running" in the variable TRIGGERED\_1C\_EVENT is set to FALSE
      - start a timer for that primary CPICH with the value of "Reporting interval" for this event and set the IE "Periodical reporting running" in the variable TRIGGERED\_1C\_EVENT to TRUE;
    - set "sent reports" for that primary CPICH in the variable TRIGGERED\_1C\_EVENTS to 1;
  - send a measurement report with IEs set as below:
    - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1c" and in the first entry in "cell measurement event results":
      - to the IE "Primary CPICH info" of the primary CPICH all entries of the "cells recently triggered" in the variable TRIGGERED\_1C\_EVENT not in the active set as well as the "primary CPICH info" of the all the primary CPICHs in the active set for which the measured value is worse (i.e. greater for pathloss and less for the other measurement quantities) than the one of the entry in "cell recently triggered" that has the best measured value. The "primary CPICH info" shall be ordered according to their measured value from the best cell to the worst one. that triggered the report; and
      - the second entry in "cell measurement event results" to the CPICH info of the primary CPICH in the active set that now is worse than the new primary CPICH and has the best measured value (lowest measured result for pathloss and highest measured result for other measurements); and
      - the rest of the entries to other primary CPICHs that are now worse than this new primary CPICH in the order of their measured value;
    - the IE "measured results" and possible "additional measured results" according to 8.4.2;
  - move all entries from "cells recently triggered" to "cells triggered" in the variable TRIGGERED\_1C\_EVENT

- if the timer for the periodical reporting has expired:
    - if that any primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1C\_EVENTS, and not included in the current active set:
      - if "Reporting interval" for this event is not equal to 0, and if "Reporting interval" "Amount of reporting" is greater larger than "sent reports" stored for that primary CPICH, in "cells triggered" in the variable TRIGGERED\_1C\_EVENTS; and
        - if the timer for that primary CPICH in the variable TRIGGERED\_1C\_EVENTS has expired:
          - increment the stored counter "sent reports" for that all CPICH in "cell triggered" in variable TRIGGERED\_1C\_EVENTS;
          - start a timer for that primary CPICH with the value of "Reporting interval" for this event;
          - send a measurement report with IEs set as below:
            - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1c" and the first entry in "cell measurement event results":
              - to the CPICH info of the primary CPICH all entries of the variable TRIGGERED\_1C\_EVENT with value of IE "sent report" smaller than value of "Amount of reporting" and that are not part of in the active set as well as the "primary CPICH info" of the all the primary CPICHs in the active set for which the measured value is worse (i.e. greater for pathloss and less for the other measurement quantities) than the one of the entry in "cell recently triggered" that has the best measured value. The "primary CPICH info" shall be ordered according to their measured value from the best cell to the worst one. that triggered the report; and
                - the second entry in "cell measurement event results" to the CPICH info of the primary CPICH in the active set that now is worse than the new primary CPICH and has the best measured value (lowest measured result for pathloss and highest measured result for other measurements); and
                  - the rest of the entries to other primary CPICHs that is now worse than this new primary CPICH in the order of their measured value;
              - the IE "measured results" and possible "additional measured results" according to 8.4.2;
  - if "sent reports" in variable TRIGGERED\_1C\_EVENT is greater than "Amount of reporting" for all entries
    - set the IE "Periodical Reporting running" in the variable TRIGGERED\_1C\_EVENT to FALSE and disable the timer for the periodical reporting
- if "Measurement quantity" is "pathloss" and Equation 3 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 4 below is fulfilled for a primary CPICH:
  - if that primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1C\_EVENTS:

- remove the entry of that primary CPICH and sent reports from "cells triggered" in the variable TRIGGERED\_1C\_EVENTS;
- if no entry in the variable TRIGGERED\_1C\_EVENT has a value of "sent reports" smaller than "Amount of reporting":
  - stop the reporting interval timers related to that primary CPICH.
  - Set the IE "Periodical reporting running" in the variable TRIGGERED\_1C\_EVENT to FALSE.

Equation 1 (Triggering condition for pathloss)

$$M_{New} \leq M_{InAS} - H_{1c} / 2$$

Equation 2 (Triggering condition for all the other measurement quantities)

$$M_{New} \geq M_{InAS} + H_{1c} / 2$$

Equation 3 (Leaving triggering condition for pathloss)

$$M_{New} > M_{InAS} + H_{1c} / 2, [\geq \text{in the formula changed to } >]$$

Equation 4 (Leaving triggering condition for all the other measurement quantities)

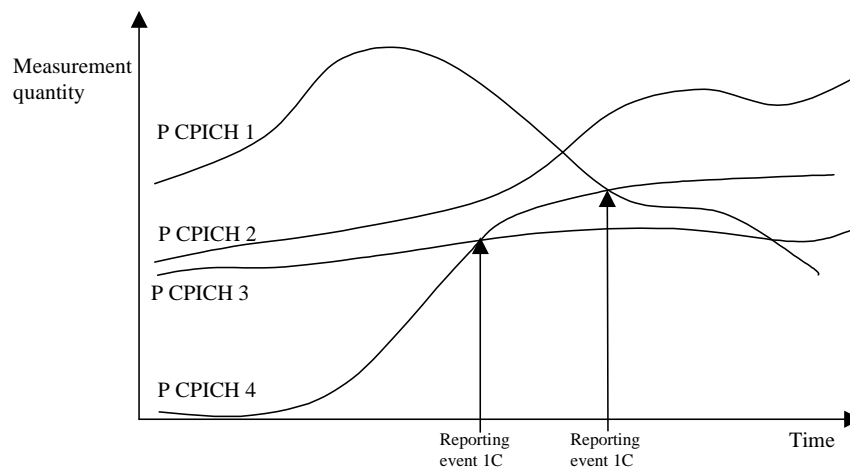
$$M_{New} < M_{InAS} - H_{1c} / 2, [ \leq \text{in the formula changed to } < ]$$

The variables in the formula are defined as follows:

$M_{New}$  is the measurement result of the cell not included in the active set.

$M_{InAS}$  is the measurement result of a cell in the active set.

$H_{1c}$  is the hysteresis parameter for the event 1c.



**Figure 63: A primary CPICH that is not included in the active set becomes better than a primary CPICH that is in the active set**

In this example the cells belonging to primary CPICH 1, 2 and 3 are supposed to be in the active set, but the cell transmitting primary CPICH 4 is not (yet) in the active set.

If a primary CPICH that is not included in the active set becomes better than a primary CPICH that is in the active set, and event 1C has been ordered by UTRAN, this event shall trigger a report to be sent from the UE.

This event may be used for replacing cells in the active set. It is activated if the number of active cells is equal to or greater than a **replacement activation threshold** parameter that UTRAN signals to the UE in the MEASUREMENT CONTROL message. This parameter indicates the minimum number of cells required in the active set for measurement reports triggered by event 1C to be transmitted.

#### 14.1.2.4 Reporting event 1D: Change of best cell

When event 1D is configured in the UE, the UE shall:

- if "Measurement quantity" is "pathloss" and Equation 1 below is fulfilled for a primary CPICH that is not stored in "Best cell" in variable BEST\_CELL\_1D\_EVENT, or if "Measurement quantity" is "CPICH Ec/NO" or "CPICH RSCP", and Equation 2 below is fulfilled for a primary CPICH that is not stored in "Best cell" in variable BEST\_CELL\_1D\_EVENT:
  - if the equations have been fulfilled during the time "Time to trigger":
    - set "best cell" in the variable BEST\_CELL\_1D\_EVENT to that primary CPICH that triggered the event;
    - send a measurement report with IEs set as below:
      - in "intra-frequency **measurement** event results"; "Intrafrequency event identity" to "1d" and "cell measurement event results" to the CPICH info of the primary CPICH that triggered the report.
      - **the IE** "measured results" and **possible the IE** "additional measured results" according to 8.4.2;

Upon transition to CELL\_DCH the UE shall:

- set "best cell" in the variable BEST\_CELL\_1D\_EVENT to the best cell of the primary CPICHs included in the active set.

Equation 1 (Triggering condition for pathloss)

$$M_{NotBest} \leq M_{Best} - H_{Id} / 2$$

Equation 2 (Triggering condition for all the other measurement quantities)

$$M_{NotBest} \geq M_{Best} + H_{Id} / 2$$

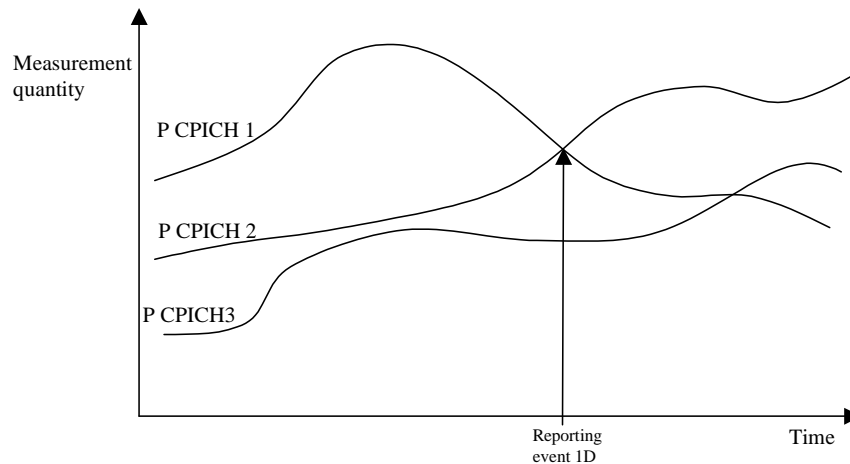
The variables in the formula are defined as follows:

$M_{NotBest}$  is the measurement result of a cell not stored in "best cell" in the variable BEST\_CELL\_1D\_EVENT.

$M_{Best}$  is the measurement result of the cell stored in "best cell" in variable BEST\_CELL\_1D\_EVENT.

$H_{Id}$  is the hysteresis parameter for the event 1d.





**Figure 64: A primary CPICH becomes better than the previously best primary CPICH**

#### 14.1.2.5 Reporting event 1E: A Primary CPICH becomes better than an absolute threshold

When event 1E is configured in the UE, the UE shall:

- if "Measurement quantity" is "pathloss" and Equation 1 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/NO" or "CPICH RSCP", and Equation 2 below is fulfilled for one or more primary CPICHs do the following for each of these primary CPICHs:
  - if the equations have been fulfilled during the time "Time to trigger", and if that primary CPICH is part of cells allowed to trigger the event according to "Triggering condition 2", and that primary CPICH is not included in the "cells triggered" in the variable TRIGGERED\_1E\_EVENTS:
    - include that primary CPICH in the "cells recently triggered" in the variable TRIGGERED\_1E\_EVENTS;
- if any primary CPICHs are stored in the "cells recently triggered" in the variable TRIGGERED\_1E\_EVENT
- send a measurement report with IEs set as below:
  - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1e" and in "cell measurement event results" to the CPICH info of the primary CPICH that triggered the report; and
  - all entries of the "cells recently triggered" in the variable TRIGGERED\_1E\_EVENT that are not part of the active set in descending order according to the configured measurement quantity - include this for each 1e event that is triggered without a report being sent;
  - the IE "measured results" and possible the IE "additional measured results" according to 8.4.2;
  - move all entries from "cells recently triggered" to "cells triggered" in the variable TRIGGERED\_1E\_EVENT

- if "Measurement quantity" is "pathloss" and Equation 3 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 4 below is fulfilled for a primary CPICH:
  - if that primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1E\_EVENTS:
    - remove that primary CPICH and sent reports from "cells triggered" in the variable TRIGGERED\_1E\_EVENTS.

Upon transition to CELL\_DCH the UE shall:

- include the primary CPICH of all cells in the current active set that fulfil the equations 1 or 2 according to the "Measurement quantity" of event 1e into the "cells triggered" in the variable TRIGGERED\_1E\_EVENTS.

Equation 1 (Triggering condition for pathloss)

$$M_{New} \leq T_{1e} - H_{1e} / 2$$

Equation 2 (Triggering condition for all the other measurement quantities)

$$M_{New} \geq T_{1e} + H_{1e} / 2$$

Equation 3 (Leaving triggering condition for pathloss)

$$M_{New} > T_{1e} + H_{1e} / 2, [\geq \text{in the formula changed to } >]$$

Equation 4 (Leaving triggering condition for all the other measurement quantities)

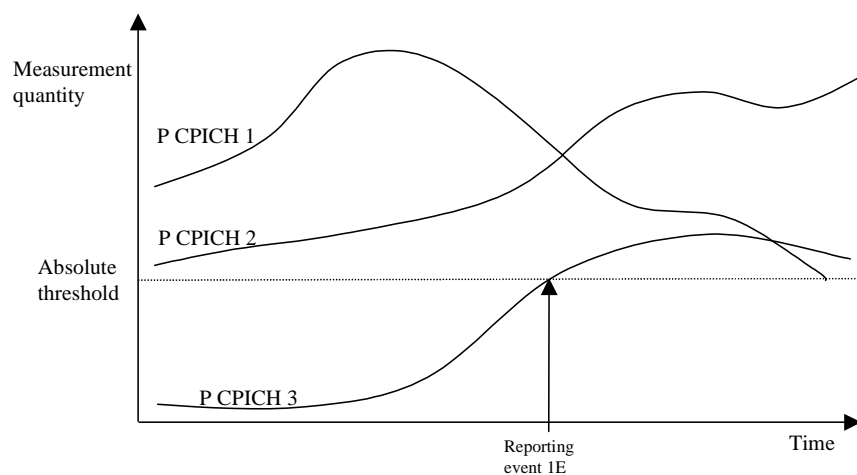
$$M_{New} < T_{1e} - H_{1e} / 2, [\leq \text{in the formula changed to } <]$$

The variables in the formula are defined as follows:

$M_{New}$  is the measurement result of a cell that becomes better than an absolute threshold.

$T_{1e}$  is an absolute threshold.

$H_{1e}$  is the hysteresis parameter for the event 1e.



**Figure 65: Event-triggered report when a Primary CPICH becomes better than an absolute threshold**

Event 1E may be used for triggering a measurement report, which includes cells, which the UE has detected without having received a neighbour cell list.

#### 14.1.2.6 Reporting event 1F: A Primary CPICH becomes worse than an absolute threshold

When event 1F is configured in the UE, the UE shall:

- if "Measurement quantity" is "pathloss" and Equation 1 below is fulfilled for one or more primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 2 below is fulfilled for one or more primary CPICHs do the following for each of these primary CPICHs:
  - if the equations have been fulfilled during the time "Time to trigger", and if that primary CPICH is part of cells allowed to trigger the event according to "Triggering condition 1", and that primary CPICH is not included in the "cells triggered" in the variable TRIGGERED\_1F\_EVENTS:
    - include that primary CPICH in the "cells recently triggered" in the variable TRIGGERED\_1F\_EVENTS;
  - if any primary CPICHs are stored in the "cells recently triggered" in the variable TRIGGERED\_1F\_EVENT
- send a measurement report with IEs set as below:
  - in "intra-frequency measurement event results": "Intrafrequency event identity" to "1f" and in "cell measurement event results" ~~to all entries of the "cells recently triggered" in the variable TRIGGERED\_1F\_EVENT that are part of the active set in descending order according to the configured measurement quantity~~ the CPICH info of the primary CPICH that triggered the report; and
  - ~~include this for each 1f event that is triggered without a report being sent;~~
  - the IE "measured results" and ~~possible~~ "additional measured results" according to 8.4.2;
  - move all entries from "cells recently triggered" to "cells triggered" in the variable TRIGGERED\_1F\_EVENT
- if "Measurement quantity" is "pathloss" and Equation 3 below is fulfilled for a primary CPICH, or if "Measurement quantity" is "CPICH Ec/N0" or "CPICH RSCP", and Equation 4 below is fulfilled for a primary CPICH:
  - if that primary CPICH is included in the "cells triggered" in the variable TRIGGERED\_1F\_EVENTS:
    - remove that primary CPICH ~~and sent reports~~ from "cells triggered" in the variable TRIGGERED\_1F\_EVENTS.

Upon transition to CELL\_DCH the UE shall:

- include the primary CPICH of all cells that fulfil the equations 1 or 2 according to the "Measurement quantity" of event 1f into the "cells triggered" in the variable TRIGGERED\_1F\_EVENTS.

Equation 1 (Triggering condition for pathloss)

$$M_{New} \geq T_{f} + H_{f} / 2$$

Equation 2 (Triggering condition for all the other measurement quantities)

$$M_{New} \leq T_{If} - H_{If} / 2,$$

Equation 3 (Leaving triggering condition for pathloss)

$$M_{New} < T_{If} - H_{If} / 2, [\leq \text{in the formula changed to } <]$$

Equation 4 (Leaving triggering condition for all the other measurement quantities)

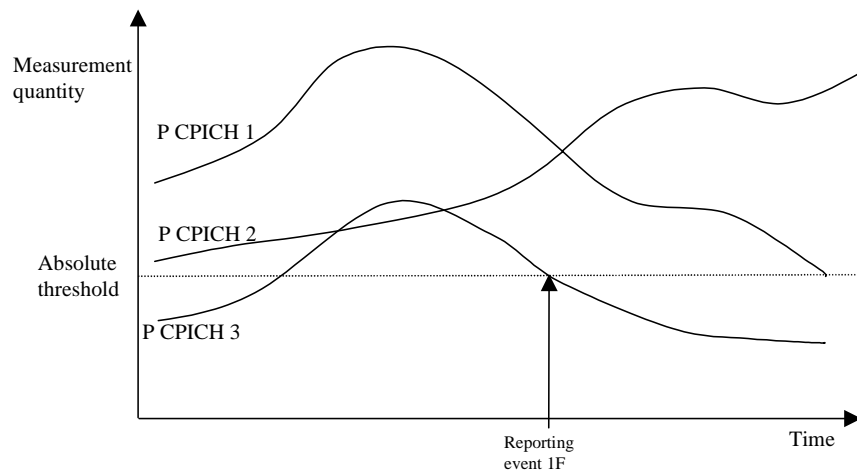
$$M_{New} > T_{If} + H_{If} / 2, [\geq \text{in the formula changed to } >]$$

The variables in the formula are defined as follows:

$M_{New}$  is the measurement result of a cell that becomes worse than an absolute threshold

$T_{If}$  is an absolute threshold

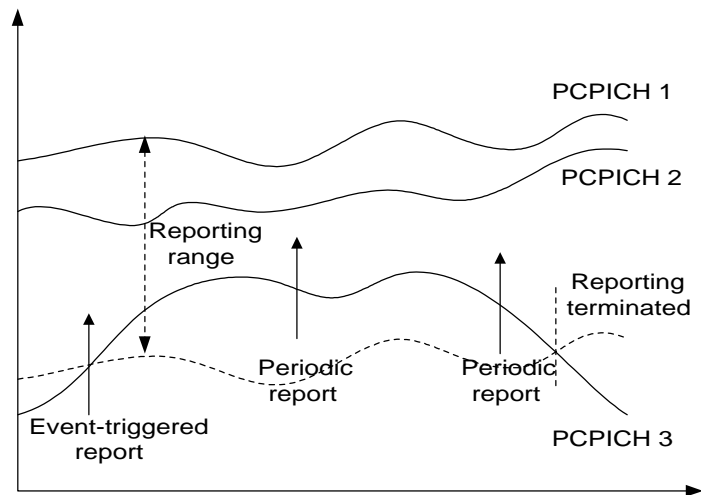
$H_{If}$  is the hysteresis parameter for the event 1f.



**Figure 66: Event-triggered report when a Primary CPICH becomes worse than an absolute threshold**

## 14.1.4 Event-triggered periodic intra-frequency measurement reports (informative)

### 14.1.4.1 Cell addition failure (FDD only)



**Figure 70: Periodic reporting triggered by event 1A**

When a cell enters the reporting range and triggers event 1A, the UE shall transmit a MEASUREMENT REPORT to the UTRAN and typically this may result in an update of the active set. However, in some situations the UTRAN may be unable to add a strong cell to the active set typically due to capacity shortage for example.

The UE shall continue reporting after the initial report by reverting to periodical measurement reporting if the reported cell is not added to the active set. This is illustrated in Figure 70. During periodic reporting the UE shall transmit MEASUREMENT REPORT messages to the UTRAN at predefined intervals. The reports shall include reporting information of the cells in the current active set and of the monitored cell(s) in the reporting range.

Event-triggered periodic measurement reporting shall be terminated if:

- there are no longer any monitored cell(s) within the reporting range; or
- the UTRAN has added cells to the active set so that it includes the maximum number of cells (defined by the **reporting deactivation threshold** parameter), which are allowed for event 1A to be triggered; or
- the UE has sent the maximum number of MEASUREMENT REPORT messages (defined by the **amount of reporting** parameter).

The reporting period is assigned by the UTRAN (with the **Reporting interval** parameter). If the reporting interval is set to zero event-triggered measurement reporting shall not be applied.

#### 14.1.4.2 Cell replacement failure (FDD only)

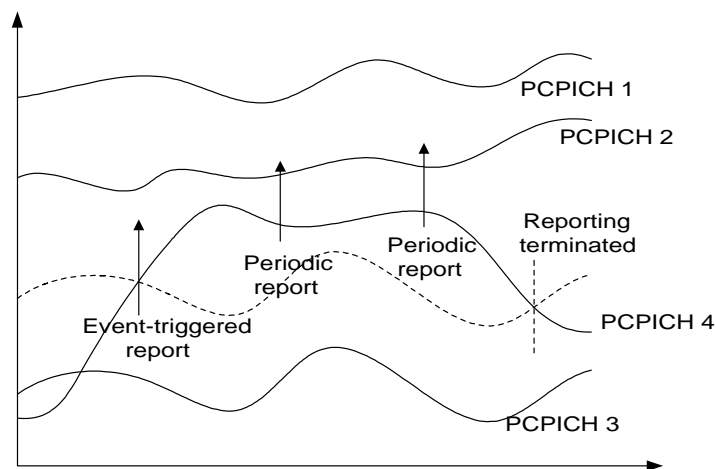


Figure 71: Periodic reporting triggered by event 1C

When a cell enters the replacement range and triggers event 1C, the UE shall transmit a MEASUREMENT REPORT to the UTRAN and typically this may result in the replacement of the weakest active cell. If the UTRAN is unable to replace the cell due to for example capacity shortage, it is beneficial to receive continuous reports in this case as well.

The UE shall revert to periodical measurement reporting if the UTRAN does not update the active set after the transmission of the measurement report. This is illustrated in Figure 71. During periodic reporting the UE shall transmit MEASUREMENT REPORT messages to the UTRAN at predefined intervals. The reports shall include reporting information of the cells in the current active set and of the monitored cell(s) in the replacement range.

Event-triggered periodic measurement reporting shall be terminated if:

- there are no longer any monitored cell(s) within the replacement range; or
- the UTRAN has removed cells from the active set so that there are no longer the minimum amount of active cells for event 1C to be triggered (as defined by the **replacement activation threshold** parameter); or
- the UE has sent the maximum number of MEASUREMENT REPORT messages (defined by the **amount of reporting** parameter).

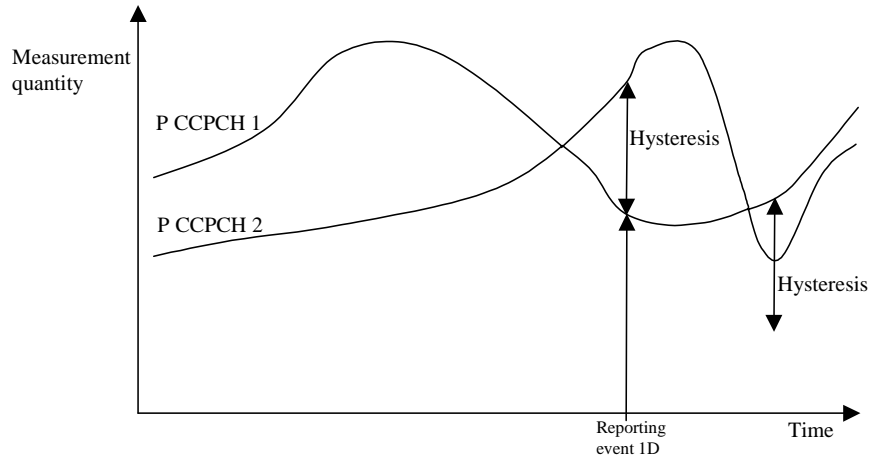
The reporting period is assigned by the UTRAN (with the **Reporting interval** parameter). If the reporting interval is set to zero, event-triggered measurement reporting shall not be applied.

### 14.1.5 Mechanisms available for modifying intra-frequency measurement reporting behaviour (informative)

#### 14.1.5.1 Hysteresis

To limit the amount of event-triggered reports, a hysteresis parameter may be connected with each reporting event given above. The value of the hysteresis is given to the UE in the Reporting criteria field of the Measurement Control message.

In the example in Figure 72, the hysteresis ensures that the event 1D (FDD) or IG(TDD) (primary CPICH(FDD)/CCPCH(TDD) 2 becomes the best cell) is not reported until the difference is equal to the hysteresis value. The fact that primary CPICH(FDD)/CCPCH(TDD) 1 becomes best afterwards is not reported at all in the example since the primary CPICH(FDD)/CCPCH(TDD) 1 does not become sufficiently better than the primary CPICH(FDD)/CCPCH(TDD) 2.

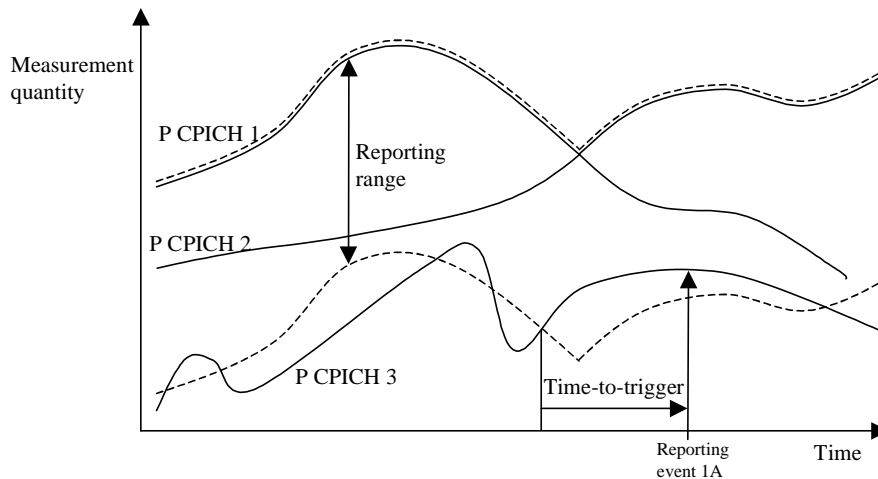


**Figure 72: Hysteresis limits the amount of measurement reports**

#### 14.1.5.2 Time-to-trigger

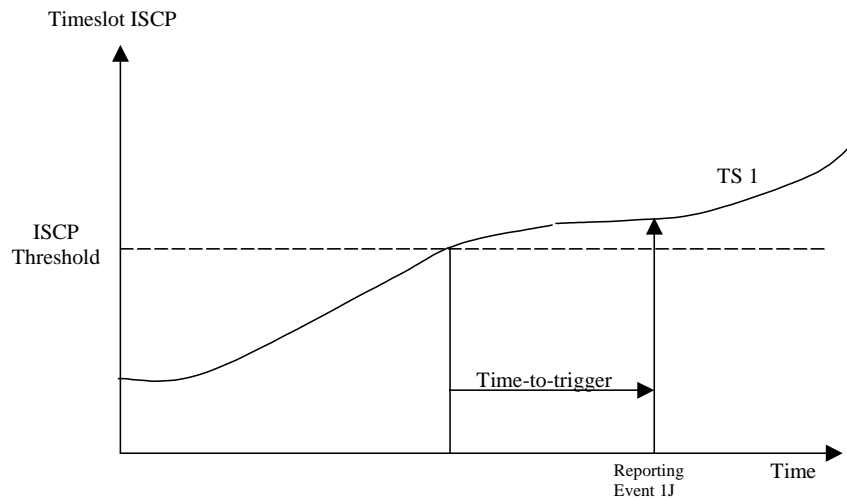
To limit the measurement signalling load, a time-to-trigger parameter could be connected with each reporting event given above. The value of the time-to-trigger is given to the UE in the Reporting criteria field of the Measurement Control message.

The effect of the time-to-trigger is that the report is triggered only after the conditions for the event have existed for the specified time-to-trigger. In the following FDD example in Figure 73, the use of time-to-trigger means that the event (primary CPICH 3 enters the reporting range) is not reported until it has been within the range for the time given by the time-to-trigger parameter.



**Figure 73: Time-to-trigger limits the amount of measurement reports**

In the following TDD example in Figure 74, the use of time-to-trigger means that the event (Timeslot ISCP upon certain threshold) is not reported until it has been upon the threshold for the time given by the time-to-trigger parameter.



**Figure 74: Time-to-trigger limits the amount of measurement reports**

NOTE: The time-to-trigger could be combined with hysteresis, i.e. a hysteresis value is added to the measurement quantity before evaluating if the time-to-trigger timer should be started.

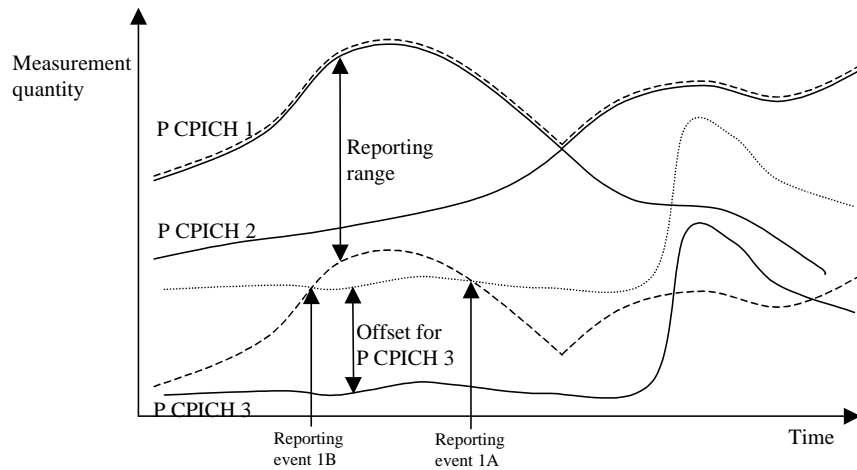
### 14.1.5.3 Cell individual offsets

For each cell that is monitored, an offset can be assigned with inband signalling. The offset can be either positive or negative. The offset is added to the measurement quantity before the UE evaluates if an event has occurred. The UE receives the cell individual offsets for each primary CPICH(FDD)/CCPCH(TDD) in the IE "Cell individual offset" included in the IE "Cell info" associated with each measurement object field of included in the MEASUREMENT CONTROL message.

For the FDD example, in Figure 75, since an offset is added to primary CPICH 3, it is the dotted curve that is used to evaluate if an event occurs. Hence, this means that measurement reports from UE to UTRAN are triggered when primary CPICH plus the corresponding offset, i.e. the dotted curve, leaves and enters the reporting range and when it gets better than primary CPICH 1 (if these events have been ordered by UTRAN). This offset mechanism provides the network with an efficient tool to change the reporting of an individual primary CPICH.

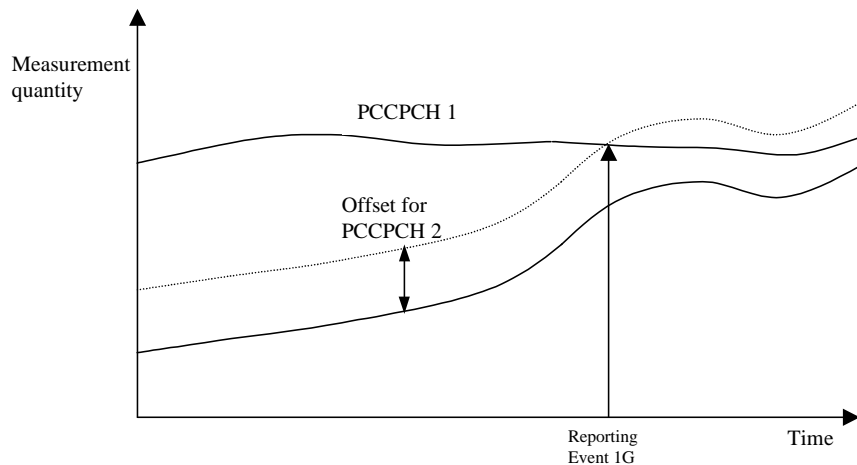
By applying a positive offset, as in Figure 75, the UE will send measurement reports as if the primary CPICH is offset  $x$  dB better than what it really is. This could be useful if the operator knows that a specific cell is interesting to monitor more carefully, even though it is not so good for the moment. In the example in Figure 75, the operator might know by experience that in this area primary CPICH 3 can become good very quickly (e.g. due to street corners) and therefore that it is worth reporting more intensively. Depending on the implemented handover evaluation algorithm, this may result in the cell with primary CPICH 3 being included in the active set earlier than would have been the case without the positive offset.





**Figure 75: A positive offset is applied to primary CPICH 3 before event evaluation in the UE**

For the TDD example, in Figure 76, an offset is added to primary CCPCH2, it is the dotted curve that is used to evaluate if the primary CCPCH2 becomes better than primary CCPCH1 (ordered by the UTRAN).



**Figure 76: A positive offset is applied to primary CCPCH 2**

Correspondingly, the operator can choose to apply a negative offset to a primary CCPCH. Then the reporting on that primary CCPCH is limited and the corresponding cell may be, at least temporarily excluded from the active set or as a target cell for handover.

The cell individual offset can be seen as a tool to move the cell border. It is important to note that the offset is added before triggering events, i.e. the offset is added by the UE before evaluating if a measurement report should be sent as opposed to offsets that are applied in the network and used for the actual handover evaluation.

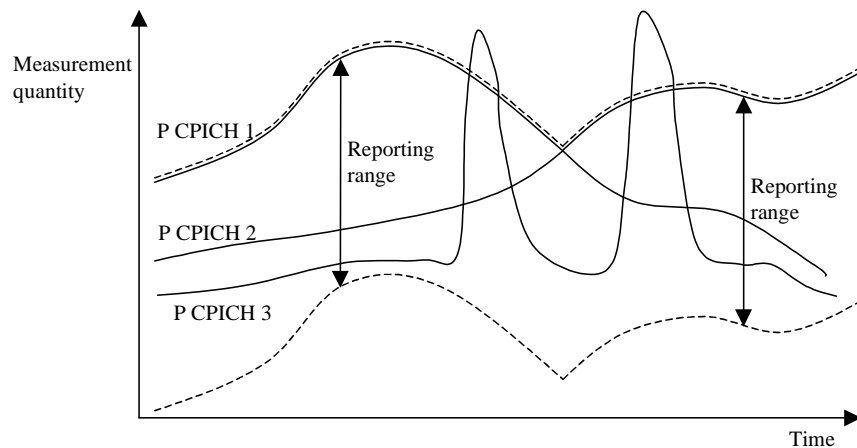
#### 14.1.5.4 Forbid a Primary CPICH to affect the reporting range (FDD only)

The reporting range affects the reporting events 1A and 1B presented above. The reporting range is defined as a function of all the Primary CPICHs in the active set (see 14.1.2.1 and 14.1.2.2). If the parameter W is set to 0, the reporting range is defined relative to the best Primary CPICH. However, there could be cases where it is good to forbid a specific Primary CPICH to affect the reporting range. For example in Figure 77 the network has requested the UE to not let Primary CPICH 3 affect the reporting range. This mechanism

could be effective if the operator knows by experience that the quality of Primary CPICH 3 is very unstable in a specific area and therefore should not affect the reporting of the other Primary CPICHs.

The UE shall ignore that a Primary CPICH is forbidden to affect the reporting range if all of the following conditions are fulfilled:

- the Primary CPICH is included in active set; and
- all cells in active set are defined as Primary CPICHs forbidden to affect the reporting range.



**Figure 77: Primary CPICH 3 is forbidden to affect the reporting range**

#### 14.1.6 Report quantities in intra-frequency measurements

The quantities that the UE shall report to UTRAN when the event is triggered for an intra-frequency measurement are given by the "Intra-frequency reporting quantity" IE stored for this measurement and can be the following:

- 1 SFN-SFN observed time difference
- 2 Cell synchronisation information
- 3 Cell Identity
- 4 Downlink  $E_c/N_0$  (FDD).
- 5 Downlink path loss.

For FDD:

Pathloss in dB = Primary CPICH Tx power - CPICH RSCP.

For Primary CPICH Tx power the IE "Primary CPICH Tx power" shall be used. The unit is dBm.

CPICH RSCP is the result of the CPICH RSCP measurement. The unit is dBm.

For TDD:

Pathloss in dB = Primary CCPCH TX power - Primary CCPCH RSCP.

For Primary CCPCH TX power the IE "Primary CCPCH TX Power" shall be used. The unit is dBm.

Primary CCPCH RSCP is the result of the Primary CCPCH RSCP measurement. The unit is dBm.

If necessary Pathloss shall be rounded up to the next higher integer.

Results higher than 158 shall be reported as 158.

Results lower than 46 shall be reported as 46.

- 5 Downlink received signal code power (RSCP) after despreading (of a primary CPICH for FDD, and of a primary CCPCH for TDD).
- 6 ISCP measured on Timeslot basis. (TDD)
- 7 Proposed TGSN (TDD)

A description of those values can be found in [7] and [8].

~~In the event triggered measurement reports, mandatory information connected to the events is always reported. For instance, at the event "a primary CPICH(FDD)/CCPCH(TDD) enters the reporting range" the corresponding report identifies the primary CPICH(FDD)/CCPCH(TDD) that entered the range. However, besides this mandatory information, UTRAN should be able to optionally require additional measurement information in the report to support the radio network functions in UTRAN. Furthermore, it will allow the UTRAN to use the UE as a general tool for radio network optimisation if necessary. Examples of report quantities that may be appended to the measurement reports are:~~

- ~~— Downlink transport channel block error rate.~~
- ~~— Downlink  $E_c/I_0$  on primary CPICH(FDD)/CCPCH(TDD) (e.g. used for initial DL power setting on new radio links).~~
- ~~— Time difference between the received primary CPICH(FDD)/CCPCH(TDD) frame timing from the target cell and the earliest received existing DPCH path. [Note: This measurement is identified in [26] (denoted  $T_m$  in clause 7)].~~
- ~~— UE transmit power.~~
- ~~— UE position.~~