

**Agenda Item:** 15.3 and 16.2

**Source:** Ericsson

**Title:** Measurements to be provided in Node B

**Document for:** Decision

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## 1. Introduction

There are several measurements that a Node B has to perform, in order to support different radio network functions. A general measurement concept has been accepted in TSG RAN WG3 to support this. This contribution aims to provide more detailed information about which measurements that should be supported.

Note that it is our understanding that:

- TSG RAN WG2 specifies which measurements that are needed from the physical layer [25.302].
- TSG RAN WG1 specifies how these measurements should be performed [25.215].
- TSG RAN WG4 specifies the performance requirements on these measurements [25.103].
- TSG RAN WG3 specifies the UTRAN support for the transport of the Node B related measurements [25.423 and 25.433].

Therefore, this contribution does not motivate the necessity of the physical layer measurements, as this has already been discussed in TSG RAN WG1 and TSG RAN WG2.

## 2. Measurements to be performed in Node B

### 2.1 Services Provided by the Physical Layer

TSG RAN WG1 have defined measurement entities to be provided by the physical layer [25.215]. TSG RAN WG2 have defined reporting criteria for these measurement entities. The measurements that are performed in Node B are shown in Table 1.

**Table 1 : Measurements Provided by the physical layer in Node B**

Measurement name		Reference		Reporting Trigger
RAN WG1	RAN WG2	[25.215]	[25.302]	(from 25.302)
RSSI	UL Load	6.2.1	9.2.1	On-demand, periodic, Event-triggered
SIR	<i>Not defined in WG2</i>	6.2.2	-	-
Total transmitted power	Total Tx Power	6.2.3	9.1.12	On-demand, periodic, Event-triggered
Transmitted Code Power	Code Tx Power	6.2.4	9.1.13	On-demand, periodic, Event-triggered
Transport CH BLER	Transport Channel BLER	6.2.5	9.2.3	On-demand, periodic, Event-triggered
Physical CH BER	Physical Channel	6.2.6	9.2.4	On-demand, periodic, Event-triggered

	BER			
Round Trip Delay (RTD)		6.2.7		
	Time of Arrival (TOA)		9.3.1	On-demand, Event-Triggered

*Note: [25.215 section 6.2.7] states that the relationship between RTD and TOA needs clarification. For that reason, both these measurements are not treated any further in this contribution.*

We propose the following mapping between the Node B measurements onto the WG3 measurement concepts (Table 2):

**Table 2 : Mapping of Node B measurements onto WG3 measurement concept**

Measurement	Affects Interface	Transport via
RSSI	Iub	Common Measurement
SIR	Iub / Iur	Dedicated Measurement
Total transmitted power	Iub	Common Measurement
Transmitted Code Power	Iub / Iur	Dedicated Measurement
Transport CH BLER	Iub / Iur	Can be calculated in the SRNC by monitoring the CRCOK flag in DCH Frame Protocol
Physical CH BER	Iub / Iur	Quality Estimate field in the DCH Frame Protocol.

*Note 1: With the mapping of the Transport Channel BLER and Physical Channel BER measurements onto the DCH Frame Protocol (as proposed in Table 2) we transport all information to the SRNC. Reporting triggers related to these entities will be SRNC internal. Therefore, these measurements are not considered further in this contribution.*

*Note 2: The in [25.423 section 8.2.9] mentioned “UL RL Quality Estimate” is not included in this contribution. A contribution describing this measurement, the use of it, and how it relates to other measurements (Transport Channel BLER or Physical Channel BER) are requested.*

## 2.2 Additional measurements

We also see a need for two additional measurements:

1. If there is an error in the message part of the random access message, we will have a situation where the Node B have acknowledged the L1 preamble ramping (and is thus aware of that a random access message should follow). However, the Node B will not be able to detect any message, and consequently, no data frame will be sent to the RNC.
2. In an UL congestion, the UL inner loop power control might never reach the ordered SIR target. In such a situation the UL Outer Loop Power Control might suffer from “wind-up” problems by increasing the SIR target to a maximum without any effect on the UL quality.

For the above-mentioned reasons, we see a need for the following measurements within the Node B.

Measurement	Affects Interface	Reporting Trigger	Transport via	Definition
Not received RA messages	Iub	On-demand, Periodic, Event-triggered	Common measurement	Node B reports the number of detected RA tries during a certain time interval, for which the message part was not possible to decode.

SIR error	Iub / Iur	On-demand, Periodic, Event-triggered	Dedicated Measurement	Node B reports the difference between the SIR-target (used by the UL inner loop power control) and the received SIR.
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## 2.3 Reporting Triggers

So, far three different reporting triggers have been discussed in TSG RAN WG2, on demand, periodic and event-triggered. We propose the following definition of the different reporting triggers (these triggers apply for the measurements RSSI, SIR, Total Transmitted Power, Transmitted Code Power, Not received RA messages and SIR error):

### 2.3.1 On-Demand

<b>Name</b>	On-Demand
<b>Definition</b>	Node B shall as soon as possible respond with a measurement report containing the requested measurement. The response time should mainly depend on the time it takes to measure the entity.
<b>Additional Parameters</b>	None

### 2.3.2 Periodic

<b>Name</b>	Periodic
<b>Definition</b>	Node B shall schedule and measure the entity so that a measurement report is delivered periodically.
<b>Additional Parameters</b>	Reporting Frequency

### 2.3.3 Event-Triggered

We propose the following events (the different events are illustrated in Appendix A) for the measurements defined in Table 2:

<b>Name</b>	Event-Driven Type A
<b>Definition</b>	Node B shall report when the measured entity rises above an absolute threshold and stays there for the hysteresis time.
<b>Additional Parameters</b>	Absolute Threshold (Mandatory) Hysteresis Time (Optional)

<b>Name</b>	Event-Driven Type B
<b>Definition</b>	Node B shall report when the measured entity falls below an absolute threshold and stays there for the hysteresis time.
<b>Additional Parameters</b>	Absolute Threshold (Mandatory) Hysteresis Time (Optional)

<b>Name</b>	Event-Driven Type C
<b>Definition</b>	Node B shall report when the measured entity increases more than the threshold within the rising time.
<b>Additional Parameters</b>	Relative Threshold (Mandatory) Rising Time (Mandatory)

<b>Name</b>	Event-Driven Type D
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<b>Definition</b>	Node B shall report when the measured entity decreases more than the threshold within the fall time.
<b>Additional Parameters</b>	Relative Threshold (Mandatory) Fall Time (Mandatory)

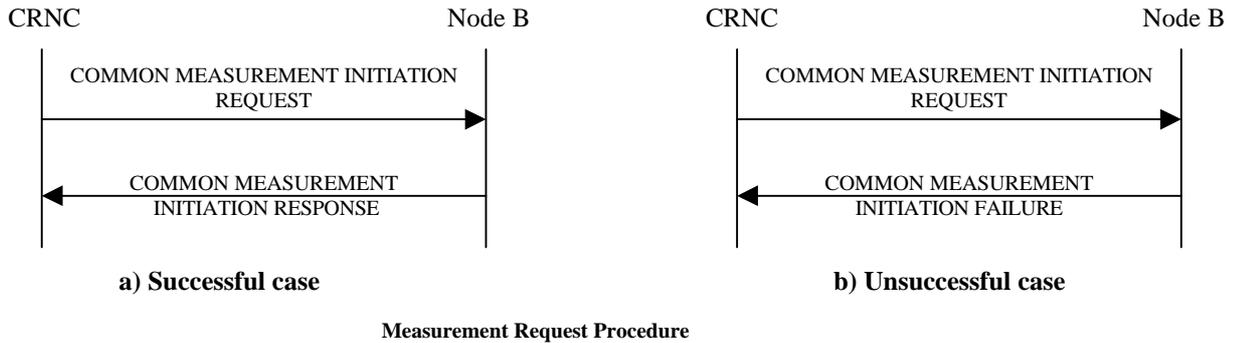
### 3. Proposals

The following subsections propose changes to 25.433 and 25.423.

#### 3.1 Changes to 25.433 – Common Measurements

##### 8.1.4.1 Measurement Request

For requesting measurements, the RNC use the following procedure:



The COMMON MEASUREMENT INITIATION REQUEST message includes the following information:

- **Measurement Id:** This is a RNC defined identifier that uniquely identifies the measurement.
- **Measurement Object:** This defines on which resource the measurement should be performed. For example might this identifier point out a cell or a carrier within the Node B.
- **Measurement Type:** This defines what measurement that should be performed. The measurements are defined in [25.215]. This-The measurements could for example be “interference on the uplink”, “Undecoded RACH frames”, or “DL Cell Power Load”.
  - **RSSI:** See [25.215]
  - **Total Transmitted Power:** See [25.215]
  - **Not received RA messages:** The number of detected random access tries during a certain time interval, for which the message part was not possible to decode.
- **Measurement Characteristics:** This defines how the measurements should be performed. For example measurement frequency, timing information, filtering information. *The exact structure and contents of this parameter is dependent on the Measurement Type and is FFS.*
- **Report Characteristics:** The reporting could be any of the following classes:

##### On-Demand

<b>Name</b>	On-Demand
<b>Definition</b>	Node B shall as soon as possible respond with a measurement report containing the requested measurement. The response time should mainly depend on the time it takes to measure the entity.
<b>Additional Parameters</b>	None

##### Periodic

<b>Name</b>	Periodic
<b>Definition</b>	Node B shall schedule and measure the entity so that a measurement report is delivered periodically.

<b><u>Additional Parameters</u></b>	<u>Reporting Frequency</u>
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**Event-Triggered**

<b><u>Name</u></b>	<u>Event-Driven Type A</u>
<b><u>Definition</u></b>	<u>Node B shall report when the measured entity rises above an absolute threshold and stays there for the hysteresis time.</u>
<b><u>Additional Parameters</u></b>	<u>Absolute Threshold (Mandatory)</u> <u>Hysteresis Time (Optional)</u>

<b><u>Name</u></b>	<u>Event-Driven Type B</u>
<b><u>Definition</u></b>	<u>Node B shall report when the measured entity falls below an absolute threshold and stays there for the hysteresis time.</u>
<b><u>Additional Parameters</u></b>	<u>Absolute Threshold (Mandatory)</u> <u>Hysteresis Time (Optional)</u>

<b><u>Name</u></b>	<u>Event-Driven Type C</u>
<b><u>Definition</u></b>	<u>Node B shall report when the measured entity increases more than the threshold within the rising time.</u>
<b><u>Additional Parameters</u></b>	<u>Relative Threshold (Mandatory)</u> <u>Rising Time (Mandatory)</u>

<b><u>Name</u></b>	<u>Event-Driven Type D</u>
<b><u>Definition</u></b>	<u>Node B shall report when the measured entity decreases more than the threshold within the fall time.</u>
<b><u>Additional Parameters</u></b>	<u>Relative Threshold (Mandatory)</u> <u>Fall Time (Mandatory)</u>

- **Periodic:** Reports should be delivered in a periodic matter with some frequency. In this case the update frequency have to be specified.
- **Event Triggered:** Reports should be delivered upon a specific event in Node B e.g Performance threshold crossing. In this case the event have to be specified.
- **Immediate Reporting:** A report should be delivered immediately. Only one measurement report should be sent and after that the measurement is automatically cancelled.

The possibility to request several measurements for the same event is FFS.

### 9.1.18 COMMON MEASUREMENT INITIATION REQUEST

Information Element	Reference	Type
Message Discriminator		M
Message Type		M
Transaction ID		M
Measurement ID		M
Measurement Object		M
Measurement Type		M
Measurement Characteristic		M
<b>Report Characteristics</b>		<b>M</b>
<b>On-Demand</b>		<b>C1</b>
<b>Periodic</b>		<b>C1</b>
Reporting Frequency		M
<b>Event-Triggered</b>		<b>C1</b>
<b>Event-Triggered Type A</b>		<b>C2</b>
Absolute Threshold		M
Hysteresis Time		O
<b>Event-Triggered Type B</b>		<b>C2</b>
Absolute Threshold		M
Hysteresis Time		O
<b>Event-Triggered Type C</b>		<b>C2</b>
Relative Threshold		M
Rising Time		M
<b>Event-Triggered Type D</b>		<b>C2</b>
Relative Threshold		M
Fall Time		M

C1 : One and only one of On-Demand, Periodic or Event-Triggered can be present at the same time.

C2: One and only one of Event A to Event D can be present at the same time.

#### **9.2.X Reporting Frequency**

The frequency with which the Node B shall send measurement reports.

#### **9.2.X Absolute Threshold**

The threshold for which the Node B shall trigger a measurement report.

#### **9.2.X Hysteresis Time**

The time for which the measurement entity has to be above/beneath the absolute threshold when a measurement report should be sent.

#### **9.2.X Relative Threshold**

The distance that the measurement entity shall rise/fall, in order to trigger a measurement report.

**9.2.X Rising Time**

The time the measurement entity shall rise on, in order to trigger a measurement report.

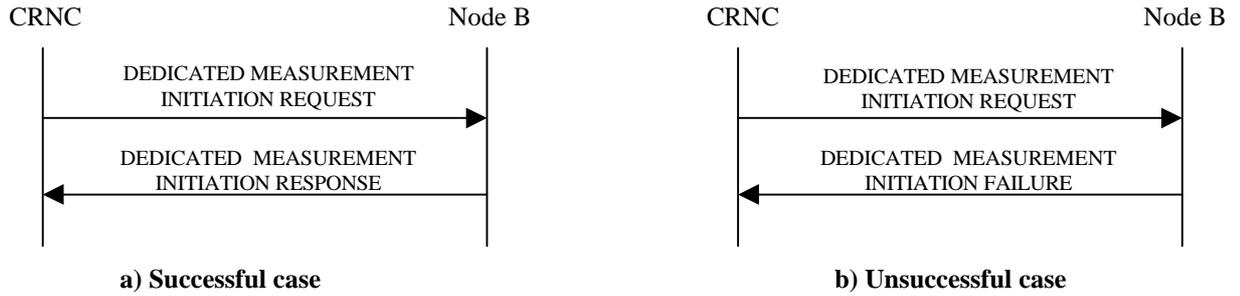
**9.2.X Fall Time**

The time the measurement entity shall fall, in order to trigger a measurement report.

**3.2 Changes to 25.433 – Dedicated Measurements**

**8.2.6.1 Measurement Request**

For requesting measurements, the RNC use the following procedure:



**Measurement Request Procedure**

The DEDICATED MEASUREMENT INITIATION REQUEST message includes the following information:

**Measurement Id:** This is a RNC defined identifier that uniquely identifies the measurement.

**Measurement Object:** This defines on which resource the measurement should be performed. For example might this identifier point out a radio link. *Other measurement objects are FFS.*

**Measurement Type:** This defines what measurement that should be performed. This could for example be ~~“used power on the downlink”~~. *Other measurement types are FFS.*

**SIR:** See [25.215]

**Transmitted Code Power:** : See [25.215]

**SIR error:** The difference between the SIR-target (used by the UL inner loop power control) and the received SIR as defined in [25.215].

**Measurement Characteristics:** This defines how the measurements should be performed. For example measurement frequency, timing information, and filtering information. *The exact structure and contents of this parameter is dependent on the Measurement Type and is FFS.*

**Report Characteristics:** The reporting could be any of the following classes:

On-Demand

<u>Name</u>	<u>On-Demand</u>
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<b>Definition</b>	Node B shall as soon as possible respond with a measurement report containing the requested measurement. The response time should mainly depend on the time it takes to measure the entity.
<b>Additional Parameters</b>	None

### Periodic

<b>Name</b>	Periodic
<b>Definition</b>	Node B shall schedule and measure the entity so that a measurement report is delivered periodically.
<b>Additional Parameters</b>	Reporting Frequency

### Event-Triggered

<b>Name</b>	Event-Driven Type A
<b>Definition</b>	Node B shall report when the measured entity rises above an absolute threshold and stays there for the hysteresis time.
<b>Additional Parameters</b>	Absolute Threshold (Mandatory) Hysteresis Time (Optional)

<b>Name</b>	Event-Driven Type B
<b>Definition</b>	Node B shall report when the measured entity falls below an absolute threshold and stays there for the hysteresis time.
<b>Additional Parameters</b>	Absolute Threshold (Mandatory) Hysteresis Time (Optional)

<b>Name</b>	Event-Driven Type C
<b>Definition</b>	Node B shall report when the measured entity increases more than the threshold within the rising time.
<b>Additional Parameters</b>	Relative Threshold (Mandatory) Rising Time (Mandatory)

<b>Name</b>	Event-Driven Type D
<b>Definition</b>	Node B shall report when the measured entity decreases more than the threshold within the fall time.
<b>Additional Parameters</b>	Relative Threshold (Mandatory) Fall Time (Mandatory)

~~**Periodic:** Reports should be delivered in a periodic matter with some frequency. In this case the update frequency have to be specified.~~

~~**Event Triggered:** Reports should be delivered upon a specific event in Node B. In this case the event have to be specified.~~

- ~~**Immediate Reporting:** A report should be delivered immediately. Only one measurement report should be sent and after that the measurement is automatically cancelled.~~

The possibility to request several measurements for the same event is FFS

### **9.1.X DEDICATED MEASUREMENT INITIATION REQUEST**

<b>Information Element</b>	<b>Reference</b>	<b>Type</b>
Message Discriminator		<u>M</u>
Message Type		<u>M</u>
Transaction ID		<u>M</u>
Measurement ID		<u>M</u>
Measurement Object		<u>M</u>
Measurement Type		<u>M</u>
Measurement Characteristic		<u>M</u>
<b>Report Characteristics<sup>1</sup></b>		<u>M</u>
<b>On-Demand</b>		<u>C1</u>
<b>Periodic</b>		<u>C1</u>
Report Frequency		<u>M</u>
<b>Event-Triggered</b>		<u>C1</u>
<b>Event-Triggered Type A</b>		<u>C2</u>
Absolute Threshold		<u>M</u>
Hysteresis Time		<u>O</u>
<b>Event-Triggered Type B</b>		<u>C2</u>
Absolute Threshold		<u>M</u>
Hysteresis Time		<u>O</u>
<b>Event-Triggered Type C</b>		<u>C2</u>
Relative Threshold		<u>M</u>
Rising Time		<u>M</u>
<b>Event-Triggered Type D</b>		<u>C2</u>
Relative Threshold		<u>M</u>
Fall Time		<u>M</u>

C1 : One and only one of On-Demand, Periodic or Event-Triggered can be present at the same time.

C2: One and only one of Event A to Event D can be present at the same time.

### **9.1.X DEDICATED MEASUREMENT INITIATION RESPONSE**

<b>Information Element</b>	<b>Reference</b>	<b>Type</b>
Message Discriminator		<u>M</u>
Message Type		<u>M</u>
Transaction ID		<u>M</u>
Measurement ID <sup>2</sup>		<u>M</u>

### **9.1.X DEDICATED MEASUREMENT INITIATION FAILURE**

<b>Information Element</b>	<b>Reference</b>	<b>Type</b>
Message Discriminator		<u>M</u>
Message Type		<u>M</u>
Transaction ID		<u>M</u>
Measurement ID <sup>3</sup>		<u>M</u>

<sup>1</sup> Can be On-Demand, Periodic or Event-Triggered

<sup>2</sup> This is the same measurement ID as that sent in Request message.

Cause		O
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### **9.1.X DEDICATED MEASUREMENT TERMINATION REQUEST**

<b><u>Information Element</u></b>	<b><u>Reference</u></b>	<b><u>Type</u></b>
<u>Message Discriminator</u>		<u>M</u>
<u>Message Type</u>		<u>M</u>
<u>Transaction ID</u>		<u>M</u>
<u>Measurement ID</u> <sup>4</sup>		<u>M</u>

### **9.1.X DEDICATED MEASUREMENT FAILURE INDICATION**

<b><u>Information Element</u></b>	<b><u>Reference</u></b>	<b><u>Type</u></b>
<u>Message Discriminator</u>		<u>M</u>
<u>Message Type</u>		<u>M</u>
<u>Transaction ID</u>		<u>M</u>
<u>Measurement ID</u> <sup>5</sup>		<u>M</u>

### **9.1.X DEDICATED MEASUREMENT REPORT**

<b><u>Information Element</u></b>	<b><u>Reference</u></b>	<b><u>Type</u></b>
<u>Message Discriminator</u>		<u>M</u>
<u>Message Type</u>		<u>M</u>
<u>Transaction ID</u>		<u>M</u>
<u>Measurement ID</u> <sup>6</sup>		<u>M</u>
<u>Time Reference</u>		<u>O</u>
<u>Value</u>		<u>M</u>

<sup>3</sup> [This is the same measurement ID as that sent in Request message.](#)

<sup>4</sup> [This is the same measurement ID as that sent in Request message.](#)

<sup>5</sup> [This is the same measurement ID as that sent in Request message.](#)

<sup>6</sup> [This is the same measurement ID as that sent in Request message.](#)

### 3.3 Changes to 25.423 – Dedicated Measurements

#### 8.2.9 Measurement Request

For requesting measurements, the SRNC use the following procedure:

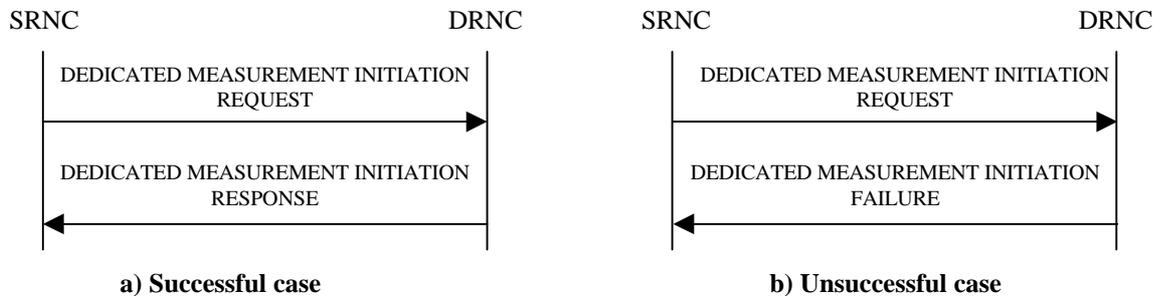


Figure 9-x: Measurement Request Procedure

The DEDICATED MEASUREMENT INITIATION REQUEST message includes the following information:

**Measurement Id:** This is a SRNC defined identifier that uniquely identifies the measurement.

**Measurement Object:** This defines on which resource the measurement should be performed. For example might this identifier point out a radio link. *Other measurement objects are FFS.*

**Measurement Type:** This defines what measurement that should be performed. This could for example be ~~“used power on the downlink” or “UL RL quality estimate”~~. ~~Other measurement types are FFS.~~

- SIR: See [25.215]
- Transmitted Code Power: See [25.215]
- SIR error: The difference between the SIR-target (used by the UL inner loop power control) and the received SIR as defined in [25.215].
- UL RL quality estimate (Editors note: The definition of this measurement type is FFS)

**Measurement Characteristics:** This defines how the measurements should be performed. For example measurement frequency, timing information, filtering information. *The exact structure and contents of this parameter is dependent on the Measurement Type and is FFS.*

**Report Characteristics:** The reporting could be any of the following classes:

On-Demand

<b><u>Name</u></b>	On-Demand
<b><u>Definition</u></b>	Node B shall as soon as possible respond with a measurement report containing the requested measurement. The response time should mainly depend on the time it takes to measure the entity.
<b><u>Additional Parameters</u></b>	None

### Periodic

<b><u>Name</u></b>	Periodic
<b><u>Definition</u></b>	Node B shall schedule and measure the entity so that a measurement report is delivered periodically.
<b><u>Additional Parameters</u></b>	Reporting Frequency

### Event-Triggered

<b><u>Name</u></b>	Event-Driven Type A
<b><u>Definition</u></b>	Node B shall report when the measured entity rises above an absolute threshold and stays there for the hysteresis time.
<b><u>Additional Parameters</u></b>	Absolute Threshold (Mandatory) Hysteresis Time (Optional)

<b><u>Name</u></b>	Event-Driven Type B
<b><u>Definition</u></b>	Node B shall report when the measured entity falls below an absolute threshold and stays there for the hysteresis time.
<b><u>Additional Parameters</u></b>	Absolute Threshold (Mandatory) Hysteresis Time (Optional)

<b><u>Name</u></b>	Event-Driven Type C
<b><u>Definition</u></b>	Node B shall report when the measured entity increases more than the threshold within the rising time.
<b><u>Additional Parameters</u></b>	Relative Threshold (Mandatory) Rising Time (Mandatory)

<b><u>Name</u></b>	Event-Driven Type D
<b><u>Definition</u></b>	Node B shall report when the measured entity decreases more than the threshold within the fall time.
<b><u>Additional Parameters</u></b>	Relative Threshold (Mandatory) Fall Time (Mandatory)

~~**Periodic:** Reports should be delivered in a periodic matter with some frequency. In this case the update frequency have to be specified.~~

~~**Event Triggered:** Reports should be delivered upon a specific event in Node B. In this case the event have to be specified.~~

~~**Immediate Reporting:** A report should be delivered immediately. Only one measurement report should be sent and after that the measurement is automatically cancelled.~~

*The possibility to request several measurements for the same event is FFS.*

## 9.1.26 DEDICATED MEASUREMENT INITIATION REQUEST

Information Element	Reference	Type
Message Type		M
Transaction ID		M
Measurement ID		M
Measurement Object		M
Measurement Type		M
Measurement Characteristics		M
<b><u>Report Characteristics</u></b>		<b><u>M</u></b>
<b><u>On-Demand</u></b>		<b><u>C1</u></b>
<b><u>Periodic</u></b>		<b><u>C1</u></b>
<u>Report Frequency</u>		<u>M</u>
<b><u>Event-Triggered</u></b>		<b><u>C1</u></b>
<b><u>Event-Triggered Type A</u></b>		<b><u>C2</u></b>
<u>Absolute Threshold</u>		<u>M</u>
<u>Hysteresis Time</u>		<u>O</u>
<b><u>Event-Triggered Type B</u></b>		<b><u>C2</u></b>
<u>Absolute Threshold</u>		<u>M</u>
<u>Hysteresis Time</u>		<u>O</u>
<b><u>Event-Triggered Type C</u></b>		<b><u>C2</u></b>
<u>Relative Threshold</u>		<u>M</u>
<u>Rising Time</u>		<u>M</u>
<b><u>Event-Triggered Type D</u></b>		<b><u>C2</u></b>
<u>Relative Threshold</u>		<u>M</u>
<u>Fall Time</u>		<u>M</u>

### **9.2.X Reporting Frequency**

The frequency with which the Node B shall send measurement reports.

### **9.2.X Absolute Threshold**

The threshold for which the Node B shall trigger a measurement report.

### **9.2.X Hysteresis Time**

The time for which the measurement entity has to be above/beneath the absolute threshold when a measurement report should be sent.

### **9.2.X Relative Threshold**

The distance that the measurement entity shall rise/fall, in order to trigger a measurement report.

### **9.2.X Rising Time**

The time the measurement entity shall rise on, in order to trigger a measurement report.

### **9.2.X Fall Time**

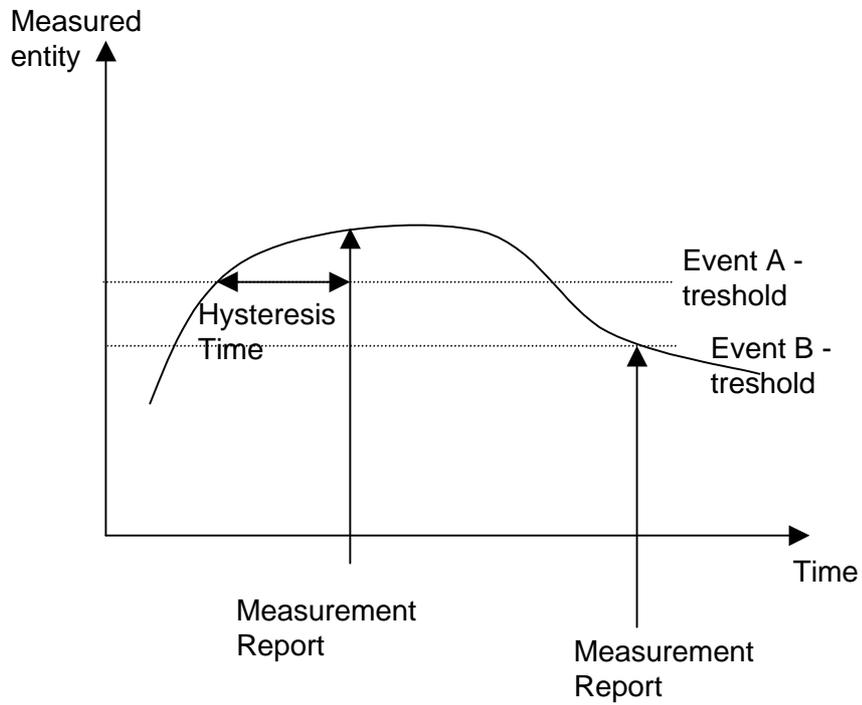
The time the measurement entity shall fall, in order to trigger a measurement report.

## 4. References

- [25.215] Physical Layer - Measurements, v.0.1.0
- [25.302] Services provided by the Physical Layer, v.2.4.0
- [25.423] UTRAN Iur Interface RNSAP Signalling, v1.3.1
- [25.433] NBAP Specification, v.1.2.0
- [25.427] Iur/Iub User Plane Protocol for DCH Data Streams, v.0.3.1

## Appendix A – Illustration of Events

### Event A (with Hysteresis Time) and Event B



### Event C and Event D

