TSG-RAN Working Group 1 meeting #9
Dresden, Germany
November 30 – December 3, 1999

TSGR1#9(99)j42

Agenda item: AH 16

Source: Ericsson

Title: CR 25.215-014, 015: Range and resolution of BER/BLER measurements

Document for: Decision

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1. Introduction

Note that this is a revised version of R1-99i74. In this document the proposal of range and resolution are divided into separate CRs for BER and BLER.

2. Range and resolution for physical channel BER and Transport channel BLER

In TS 25.427 Iur/Iub User plane protocol for DCH data streams, section 8.2.4.5 the Quality Estimate (QE) is currently defined as:

QE = - Log10 (Physical channel BER)
Value range: {0-25.5}, granularity 0.1.
Field length: 8 bits.

The range proposed in 25.427 goes down to BER values as low as $3.2*10^{-26}$ (QE=25.5). That seems to be somewhat low and the actual interesting area for the BER is somewhere between 0,1 to 10%. Representing values down to 10^{-26} will also imply that the resolution in the BER interval of interest will be worse than if a smaller range is choosen, using the same number of bits. In figure 1 below the mapping defined in 25.427 is shown together with a proposal for a new mapping (both using 8 bits = 256 values).

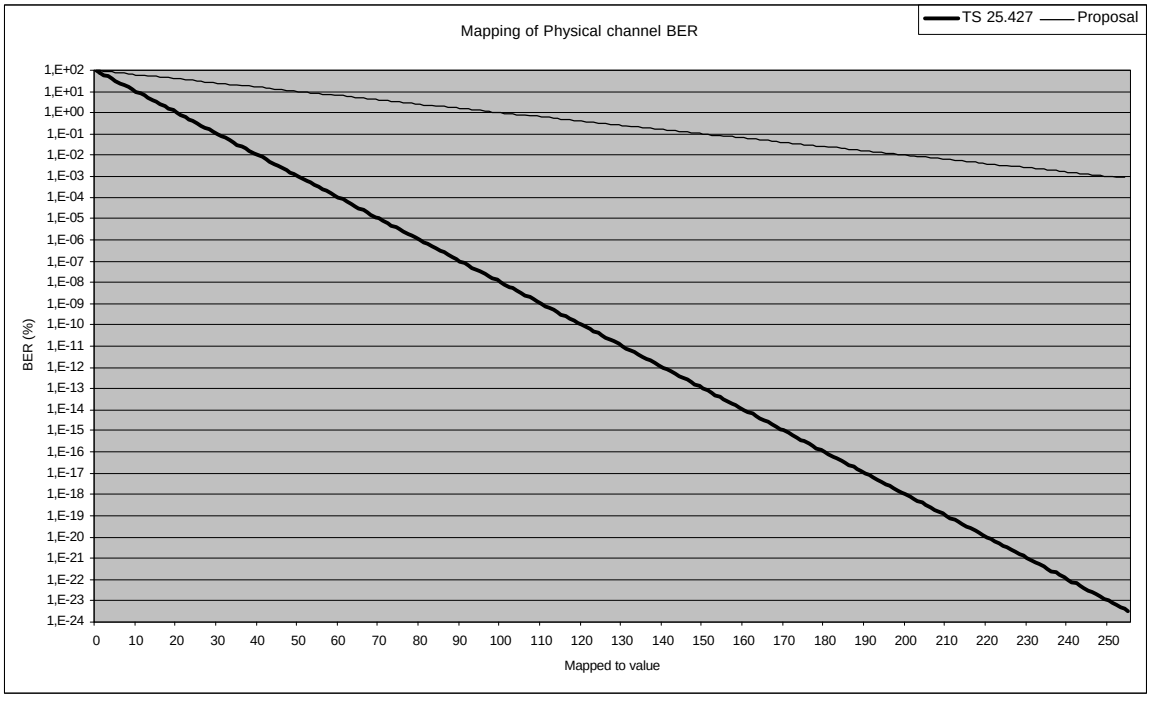

Figure 1 Mapping of physical channel BER

Mapping of the Physical channel BER in the proposal:

BER_dB%=-Log10(Physical channel BER), with value range [0 - 5.08] in step of 0.02 for Physical channel BER>0
BER_dB%=5.10 for Physical channel BER=0.

This mapping makes it possible to represent BER down to approx. 10^{-5}. Consider a worst case where the uplink channel bit rate is 960kbps (SF=4). The maximum TTI is 80ms, which leads that the maximum number of bits received during 80ms will be 960kbps x 80ms = 76800. To resolve one erroneous bit a resolution of $1/76800 = 1.3*10^{-5}$ is required. The lowest resolvable BER (except BER=0) in the proposal is $10^{-5.08} = 0.83*10^{-5}$ which will be sufficient.

As BER=0 is included in the range it will be possible to resolve even smaller BER values if several BER measurements are accumulated.

It also proposed to use the same mapping for the Transport channel BLER. To resolve BLER values down to the proposed BLER = $10^{-5.08}$ a minimum of $10^{5.08}$ transport blocks needs to be received. Consider a TrCh with TTI=10ms which will give a minimum averaging period of $10^{5.08}$ x ($10*10^{-3}$) = 1202 sec. = 20 minutes, which should be sufficient.

In figure 2 and 3 below the quantisation step size for the current mapping in TS 25.427 and the proposed mapping of physical channel BER is shown.

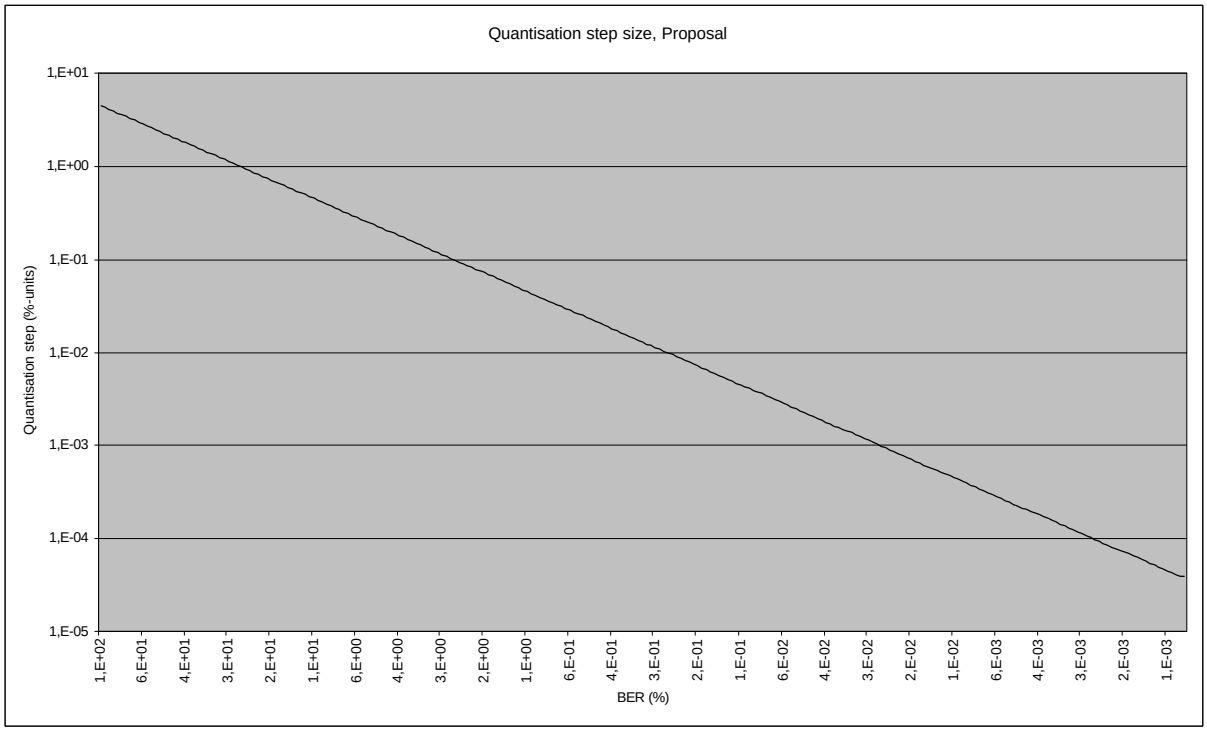

Figure 2 Quantisation step size for the mapping in TS 25.427

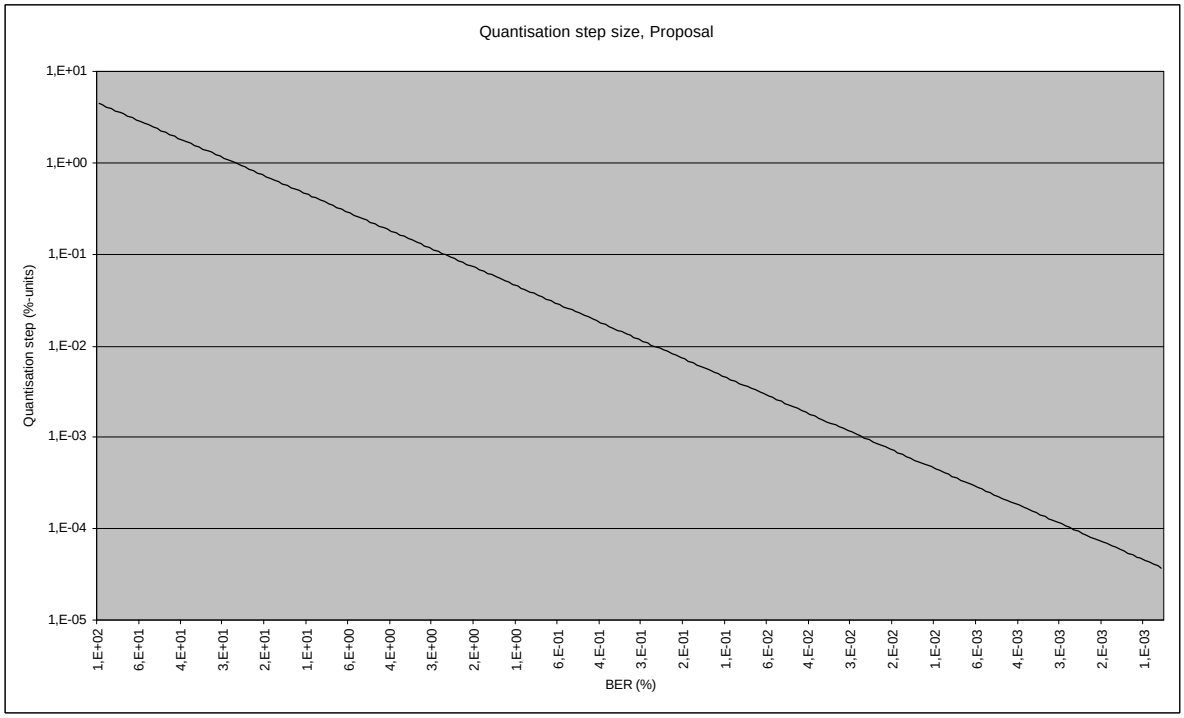

Figure 3 Quantisation step size for the proposed mapping

In the table below the quantisation step is shown around BER 0,1%, 1% and 10%

TS 25.427 BER (%)	**Proposal BER (%)**
12,5893	10,471
10,0000	10,000
7,9433	9,550
…	…
1,2589	1,047
1,0000	1,000
0,7943	0,955
…	…
0,1259	0,105
0,1000	0,100
0,0794	0,095

3. Proposal

It is proposed to use above proposed mapping of Physical channel BER for both UTRAN and the UE according to CR 25.215-014. It is proposed to use the above proposed mapping of Transport channel BLER for both UTRAN and the UE according to CR 25.215-015.

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Document ????99???
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or for SMG, use the format P-99-xxx

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25.215	**CR**	**014**	Current Version:	3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #6 *list expected approval meeting # here ↑*

for approval [X] for information [ ]

strategic [ ] non-strategic [ ] *(for SMG use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]

Source: Ericsson **Date:** 1999-11-24

Subject: Range and resolution of BLER measurements

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	[X]
A	Corresponds to a correction in an earlier release	[ ]
B	Addition of feature	[ ]
C	Functional modification of feature	[ ]
D	Editorial modification	[ ]

Release:

Phase 2	[ ]
Release 96	[ ]
Release 97	[ ]
Release 98	[ ]
Release 99	[X]
Release 00	[ ]

Reason for change: Currently there is no range and resolution specified for the Transport channel BLER measurements in TS 25.215.

Clauses affected: 5.1.8 Transport channel BLER
5.2.5 Transport channel BLER

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:

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5.1.8 Transport channel BLER

Definition	Estimation of the transport channel block error rate (BLER). The BLER estimation shall be based on evaluating the CRC on each transport block after RL combination. BLER estimation is only required for transport channels containing CRC. In connected mode the BLER shall be possible to measure on any transport channel. If requested in idle mode it shall be possible to measure the BLER on transport channel PCH.
Applicable for	Idle, Connected Intra
Range/mapping	The Transport channel BLER shall be reported in the unit BLER_dB% where: BLER_dB%=-Log10(Transport channel BLER), with value range [0 - 5.08] in step of 0.02 for Transport channel BLER >0 BLER_dB%=5.10 for Transport channel BLER =0.

5.1.9 Physical channel BER

Definition	The physical channel BER is an estimation of the average bit error rate (BER) before channel decoding of the DPDCH data after RL combination. At most it shall be possible to report a physical channel BER estimate at the end of each TTI for the transferred TrCh's, e.g. for TrCh's with a TTI of x ms a x ms averaged physical channel BER shall be possible to report every x ms.
Applicable for	Connected Intra
Range/mapping	

5.1.10 UE transmitted power

Definition	The total UE transmitted power on one carrier. The reference point for the UE transmitted power shall be the UE antenna connector.
Applicable for	Connected Intra
Range/mapping	

5.1.11 CFN-SFN observed time difference

Definition	The CFN-SFN observed time difference to cell is defined as: OFF×38400+ T_m, where: T_m= T_{RxSFN} - (T_{UETx}-T_0), given in chip units with the range [0, 1, …, 38399] chips T_{UETx} is the time when the UE transmits an uplink DPCCH/DPDCH frame. T_0 is defined in TS 25.211 section 7.1.3. T_{RxSFN} is time at the beginning of the next received neighbouring P-CCPCH frame after the time instant T_{UETx}-T_0in the UE. If the next neighbouring P-CCPCH frame is received exactly at T_{UETx}-T_0 then T_{RxSFN}=T_{UETx}-T_0 (which leads to T_m=0). and OFF=(CFN_{Tx}-SFN) mod 256, given in number of frames with the range [0, 1, …, 255] frames CFN_{Tx} is the connection frame number for the UE transmission of an uplink DPCCH/DPDCH frame at the time T_{UETx}. SFN = the system frame number for the neighbouring P-CCPCH frame received in the UE at the time T_{RxSFN}.
Applicable for	Connected Inter, Connected Intra
Range/mapping	Time difference is given with the resolution of one chip with the range [0, …, 9830399] chips.

5.1.12 SFN-SFN observed time difference

Definition	**Type 1:** The SFN-SFN observed time difference to cell is defined as: OFF×38400+ T_m, where: T_m= T_{RxSFNj} - T_{RxSFNi}, given in chip units with the range [0, 1, …, 38399] chips T_{RxSFNj} is the time at the beginning of a received neighbouring P-CCPCH frame from cell j. T_{RxSFNi} is time at the beginning of the next received neighbouring P-CCPCH frame from cell i after the time instant T_{RxSFNj} in the UE. If the next neighbouring P-CCPCH frame is received exactly at T_{RxSFNj} then T_{RxSFNj}= T_{RxSFNi} (which leads to T_m=0). and OFF=(SFN_j- SFN_i) mod 256, given in number of frames with the range [0, 1, …, 255] frames SFN_j = the system frame number for downlink P-CCPCH frame from cell j in the UE at the time T_{RxSFNj}. SFN_i = the system frame number for the P-CCPCH frame from cell i received in the UE at the time T_{RxSFNi}. **Type 2:** The relative timing difference between cell j and cell i, defined as $T_{CPICHRxj}$ - $T_{CPICHRxi}$, where: $T_{CPICHRxj}$ is the time when the UE receives one CPICH slot from cell j $T_{CPICHRxi}$ is the time when the UE receives the CPICH slot from cell i that is closest in time to the CPICH slot received from cell j
Applicable for	**Type 1:** Idle, Connected Intra **Type 2:** Idle, Connected Intra, Connected Inter
Range/mapping	**Type 1:** Time difference is given with a resolution of one chip with the range [0, …, 9830399] chips. **Type 2:** Time difference is given with a resolution of 0.5 chip with the range [-1279, …, 1280] chips.

5.1.13 UE Rx-Tx time difference

Definition	The difference in time between the UE uplink DPCCH/DPDCH frame transmission and the first significant path, of the downlink DPCH frame from the measured radio link. Measurement shall be made for each cell included in the active set. Note: The definition of "first significant path" needs further elaboration.
Applicable for	Connected Intra
Range/mapping	Always positive.

5.2 UTRAN measurement abilities

The structure of the table defining a UTRAN measurement quantity is shown below:

Column field	**Comment**
Definition	Contains the definition of the measurement.
Range/mapping	Gives the range and mapping to bits for the measurements quantity.

5.2.1 RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the UTRAN uplink carrier channel bandwidth in an UTRAN access point. The reference point for the RSSI measurements shall be the antenna connector.
Range/mapping	

5.2.2 SIR

Definition	Signal to Interference Ratio, is defined as the RSCP divided by the ISCP. Measurement shall be performed on the DPCCH after RL combination in Node B. The reference point for the SIR measurements shall be the antenna connector.
Range/mapping	

5.2.3 Transmitted carrier power

Definition	Transmitted carrier power, is the total transmitted power on one carrier from one UTRAN access point. Measurement shall be possible on any carrier transmitted from the UTRAN access point. The reference point for the total transmitted power measurement shall be the antenna connector. In case of Tx diversity the total transmitted power for each branch shall be measured.
Range/mapping	

5.2.4 Transmitted code power

Definition	Transmitted code power, is the transmitted power on one carrier, one scrambling code and one channelisation code. Measurement shall be possible on any channelisation code transmitted from the UTRAN access point. The reference point for the transmitted code power measurement shall be the antenna connector. In case of Tx diversity the transmitted code power for each branch shall be measured.
Range/mapping	

5.2.5 Transport channel BLER

Definition	Estimation of the transport channel block error rate (BLER). The BLER estimation shall be based on evaluating the CRC on each transport block. Measurement shall be possible to perform on any transport channel after RL combination in Node B. BLER estimation is only required for transport channels containing CRC.
Range/mapping	The Transport channel BLER shall be reported in the unit BLER_dB% where: BLER_dB%=-Log10(Transport channel BLER), with value range [0 - 5.08] in step of 0.02 for Transport channel BLER >0 BLER_dB%=5.10 for Transport channel BLER =0.

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D	Editorial modification	[ ]

Release:

Phase 2	[ ]
Release 96	[ ]
Release 97	[ ]
Release 98	[ ]
Release 99	[X]
Release 00	[ ]

Reason for change: Currently there is no range and resolution specified for the Physical channel BER measurements in TS 25.215.

Clauses affected: 5.1.9 Physical channel BER
5.2.6 Physical channel BER

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
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Applicable for	Connected Intra
Range/mapping	The Physical channel BER shall be reported in the unit BER_dB% where: BER_dB%=-Log10(Physical channel BER), with value range [0 - 5.08] in step of 0.02 for Physical channel BER>0 BER_dB%=5.10 for Physical channel BER=0.

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Range/mapping	

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Applicable for	Connected Inter, Connected Intra
Range/mapping	Time difference is given with the resolution of one chip with the range [0, …, 9830399] chips.

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Range/mapping	

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Range/mapping	

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