3GPP TSG RAN Meeting #27 **RP-050105**
Tokyo, Japan, 9 - 11 March 2005

3GPP TSG-SA4#34 meeting *Tdoc S4 (05)0214*
February 21-25, 2005, Lisbon, Portugal

Title: **Reply to "Reply LS on guidance and error patterns for MBMS streaming simulations"**

Source: 3GPP TSG SA WG4

To: 3GPP TSG RAN and 3GPP TSG GERAN

Cc:

Attached: S4-040803

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1. Introduction

3GPP TSG SA4 (in short: SA4) thanks TSG RAN for the reply in RP-040546=TSGS#26(04)0893=S4-050009 on error patterns for MBMS. SA4 would like to give the following answers:

> *Another joint subject (not related to MBMS) arose which is the ongoing TSG RAN (WG2) activities on ROHC for VoIP (IMS) for which support from SA4 may be necessary also e.g. utilization of ROHC in SA4 simulation work.*

SA4 informs TSG RAN and TSG GERAN that SA4 has no work item and no resources to run simulations on this area currently.

> *The MBMS performance requirements defined by TSG RAN WG4 will not be completed before September 05, and this work is linked to the request from SA4*

SA4 needs the information well before September 2005 and suggests a discussion at the RAN4 MBMS ad-hoc Meeting on April 4-6, 2005.

> *TSG RAN discussed whether the FEC layer discussed in SA4 should not be included in the overall analysis of the system requirements and performance (in particular in relation to the RAN WG4 activities)*
>
> *It was also mentioned that ROHC may also be taken into account since it impacts the error patterns seen by the application layer*

SA4 believes that the FEC on application layer should be part of the overall performance studies. ROHC should also be taken into account in case it is specified for Rel-6. After selection of an FEC code, SA4 will provide information required to perform simulations on the application layer.

SA4 would like to inform TSG RAN and TSG GERAN that SA4 has made a working assumption to use the approach described in S4-040803 to study the quality of multimedia services (video, audio, etc.) when delivered over IMS. The proposed methodology includes two parts: (1) Generation and use of link level PDU loss patterns for 3GPP bearers and (2) a network simulator to introduce packet losses in RTP streams.

SA4 would like RAN to review the link level PDU error masks (in Section 2.1 and Appendix C of S4-040803) and advise SA4 on the applicability of these masks to investigate multimedia quality issues in IMS.

SA4 would like RAN and GERAN to review the RTP Packet Loss Simulator (in Section 2.2 and Appendix A of S4-040803) and advise SA4 on the applicability of this approach to introduce packet losses in multimedia streams delivered over RTP in IMS.

2. Actions:

- RAN4 and SA4 delegates to have a joint meeting at the MBMS workshop on April 4-6, 2005.

- RAN and GERAN to review and provide feedback on link level PDU error masks and RTP packet loss simulator.

3. Dates of Next TSG-SA4 Meetings:

SA4#35	9 – 13 May 2005	San Diego, CA, USA

3GPP TSG-SA-WG4 #33 Meeting **Tdoc S4-040803**
November 22-26, 2004, Helsinki, Finland

Agenda Item : 6.5

Source : Qualcomm Europe S.A.R.L., Toshiba Corporation

Title : Video Network Simulator and Error Masks for 3GPP Services

Document for : Information

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1 Introduction

This contribution presents error masks generated from link level simulations at various bearer rates and BLER values. These masks are expected to be used to characterize video services in 3GPP.

This contribution also proposes a method for introducing packet losses on 3GPP networks for RTP/UDP/IP bitstreams. It is based on the VCEG network simulator [1], adopted by VCEG during the development of H.264/AVC codec. This simulator primarily addresses packet losses for video streams over RTP/UDP/IP transport. However, it can be used for other data also when delivered over RTP/UDP/IP transport. Two modifications are introduced to (i) enable use of packet error masks and (ii) enable the simulator to perform correctly when lower layers support multiple PDU sizes for a given TTI [2].

2 Network Simulation software for 3GPP video applications

2.1 Packet error masks for 3GPP SA4 simulations

ASCII packet error masks for MBMS, PSC and PSS are summarized below. The error masks are a sequence of '1's and '0's. '0' indicates that the PDU is not lost and '1' indicates that the PDU is lost. These error masks can be used to inject errors at the physical layer. For every PDU transmitted one mask is read from the error mask file. If the mask is 0, the PDU is considered to be received successfully else the PDU should be discarded (i.e., not given to the receiver/video decoder). Details of generation of the error masks are in Appendix C. List of the error mask file are in Appendix B. The files contain one mask value in ASCII per line.

Table 1 Naming convention of the error masks

Naming Convention	[MBMS|PSC]_bitrate_TTI_BLER-Value
MBMS	Masks for MBMS simulations
PSC	Masks for PSC/PSS simulations (with power control)
Bitrate	16, 32, 48, 64 and 128 kbps
TTI	80ms for MBMS and 20 ms for PSC/PSS
BLER	1.5%, 1% and 0.5%

The PDU size in octets is calculated as

PDU_size_in_octets = (bitrate / 8) * TTI

e.g. MBMS_128kbps_80ms_BLER_0_5 PDU size = (128/8) * 80 = 1280 octets

PSC__64kbps_20ms_BLER_0_5 PDU size = (64/8) * 20 = 160 octets

For PSC services, the total BLER should be twice that of PSS, to account for uplink and downlink packet losses. To simulate end-to-end video quality, one needs uncorrelated error masks for uplink and downlink. In this situation, the error masks are reversed and a “logical OR” operation is performed with the forward masks. This will result in error masks of BLER=3%, 2% and 1%.

Figures 1—6 show the distribution of burst errors presented here. It can be seen that only PSC__XXXkbps_20ms_BLER_0_5 appears a little different for different kbps This is because PSC__128kbps_20ms_BLER_0_5.txt has burst errors of lengths of 1, 2, 3, and 4 while the others have burst errors of only lengths 1 and 2.

As a first approximation, it appears reasonable to assume that burst statistics do not vary much with the bearer rate. Consequently, if the video rate changes due to rate adaptation, the same error mask is applicable to all data rates to assess the effects of packet loss .

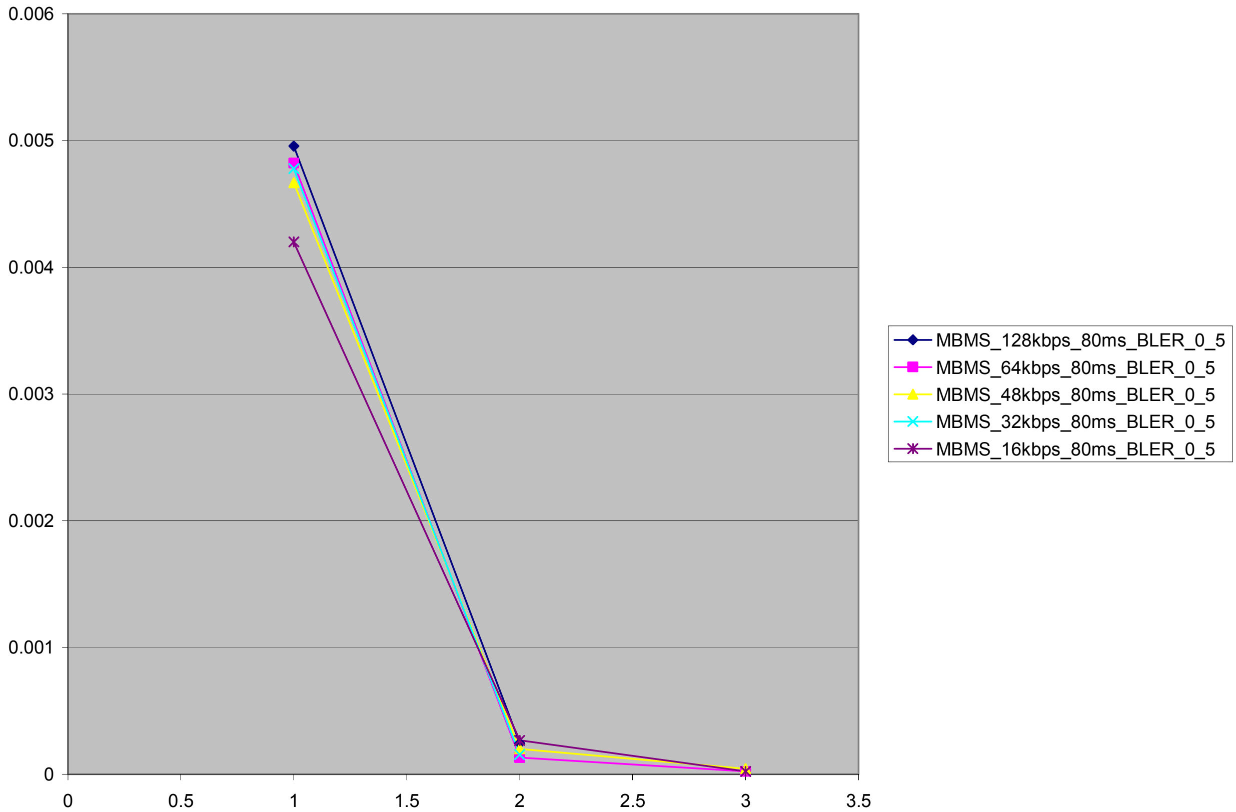

Figure 1 MBMS Burst Error Distribution at 0.5% BLER

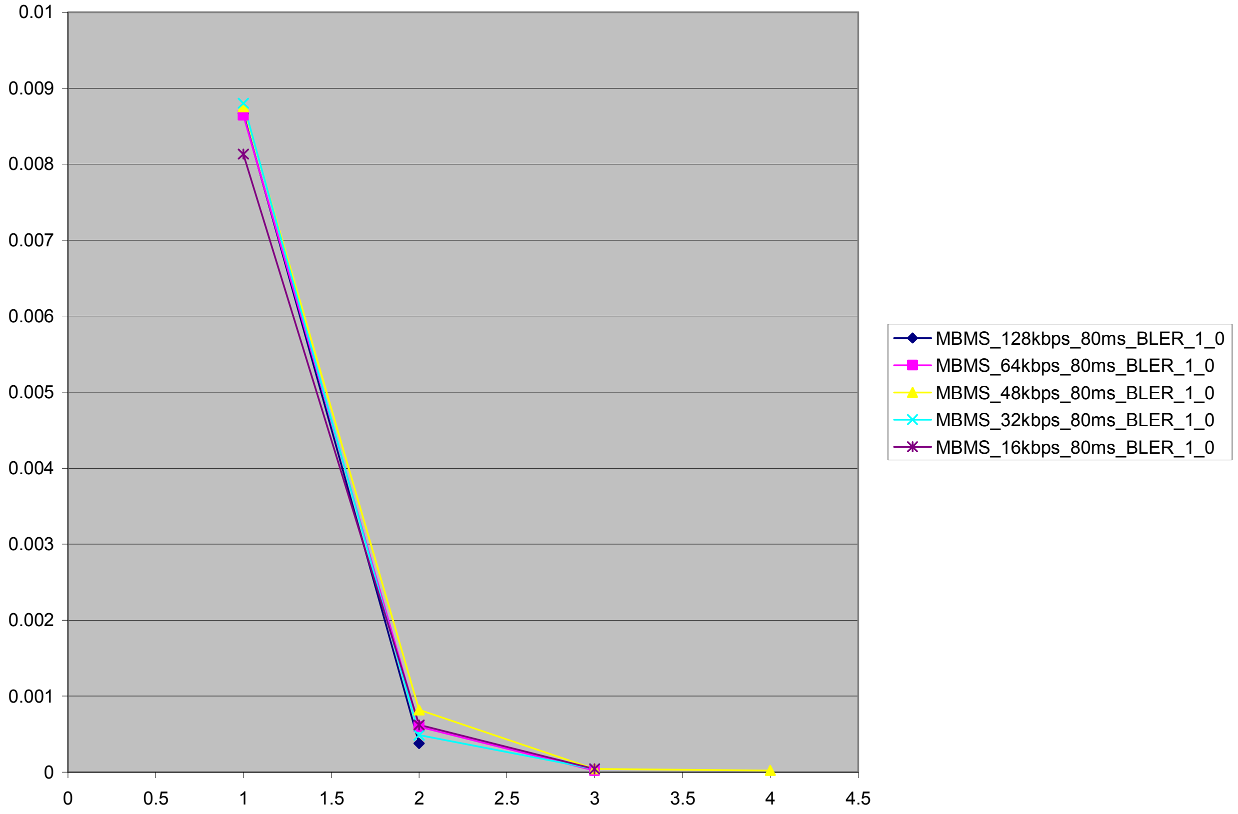

Figure 2 MBMS Burst Error Distribution at 1% BLER

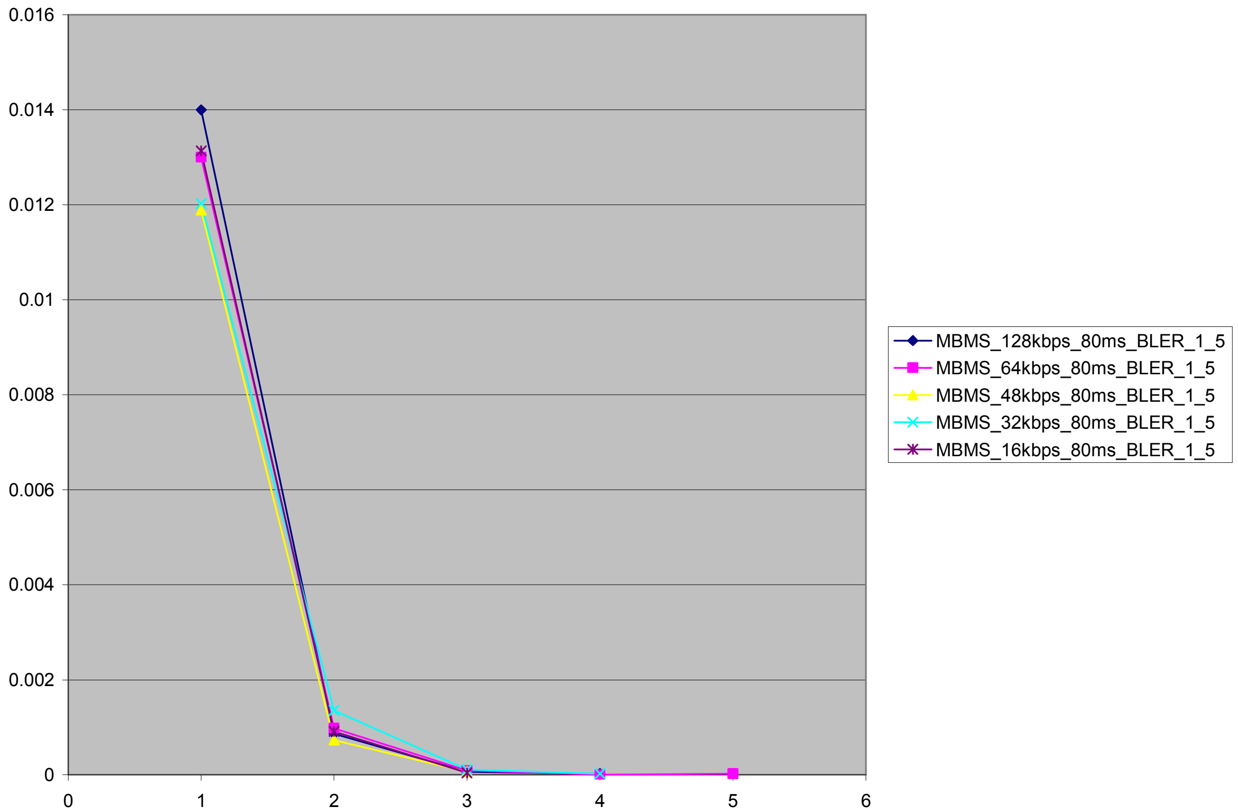

Figure 3 MBMS Burst Error Distribution at 1.5% BLER

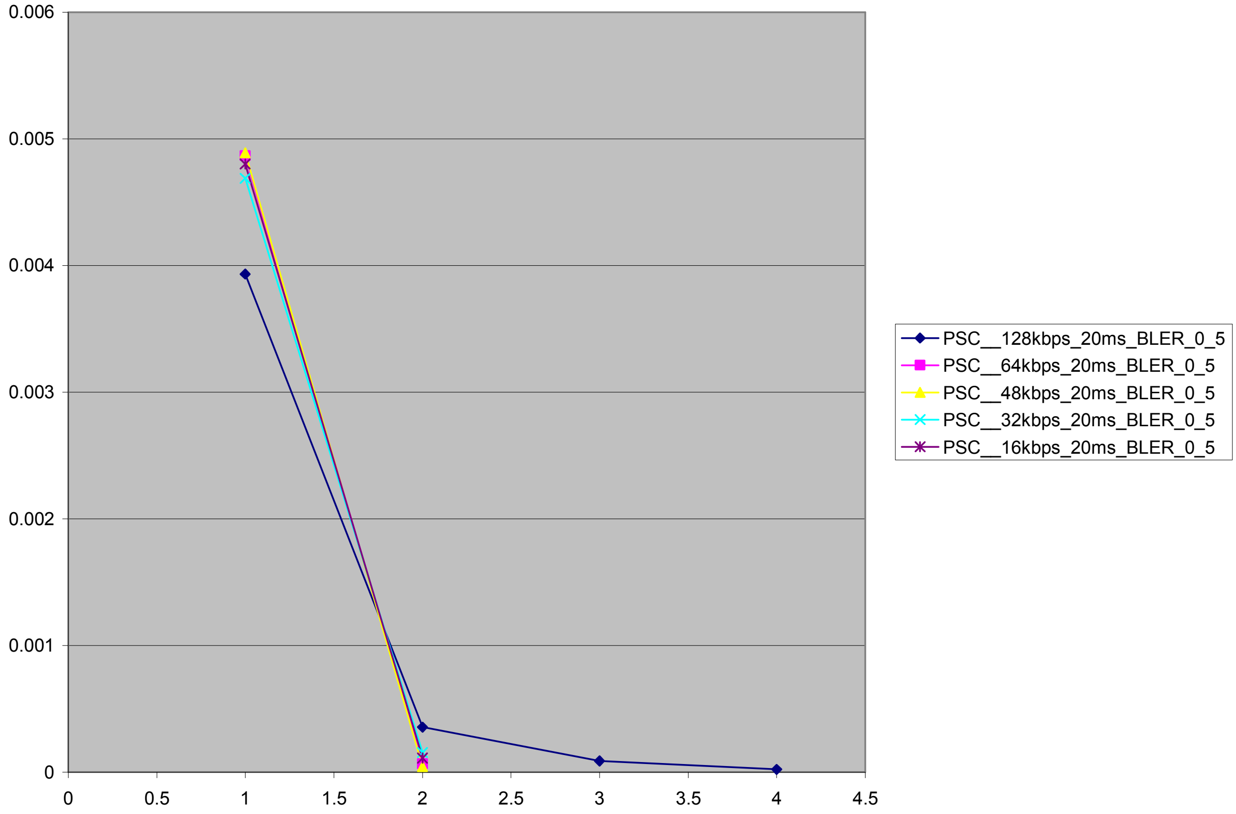

Figure 4 PSC/PSS Burst Error Distribution at 0.5% BLER

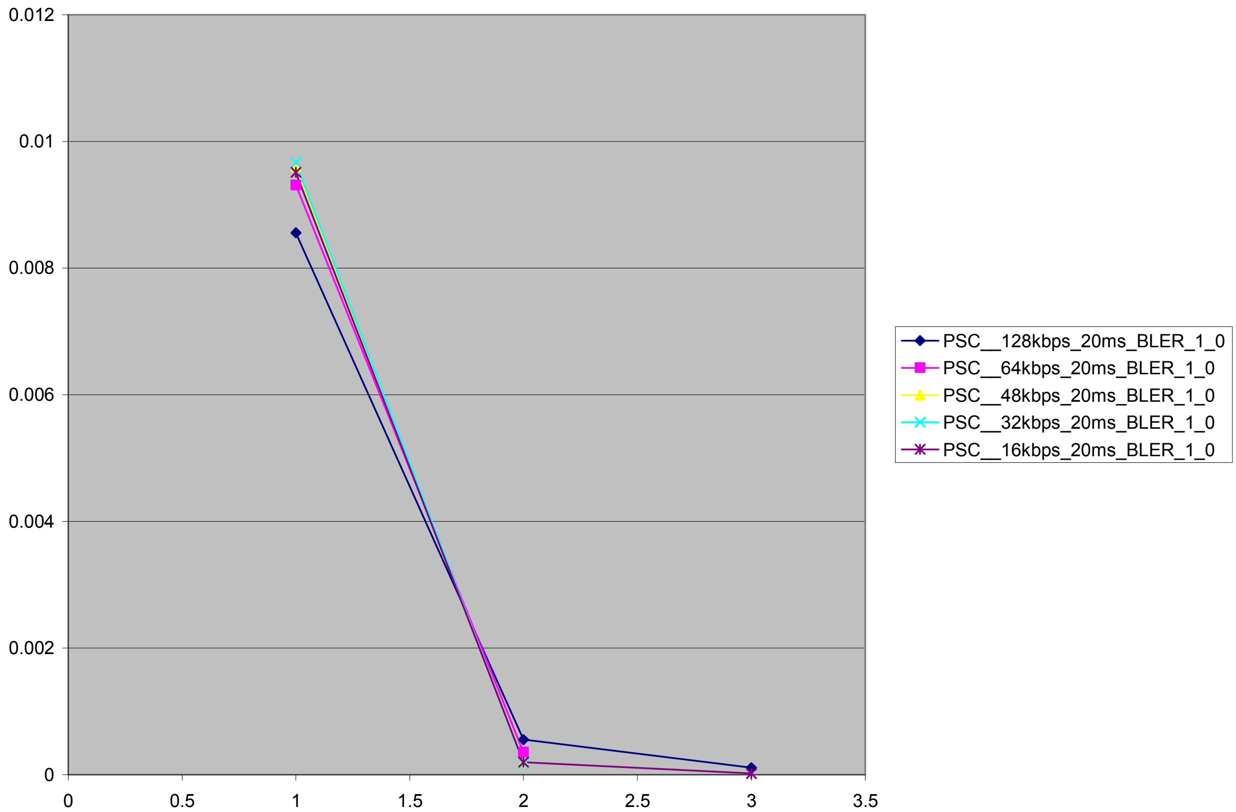

Figure 5 PSC/PSS Burst Error Distribution at 1% BLER

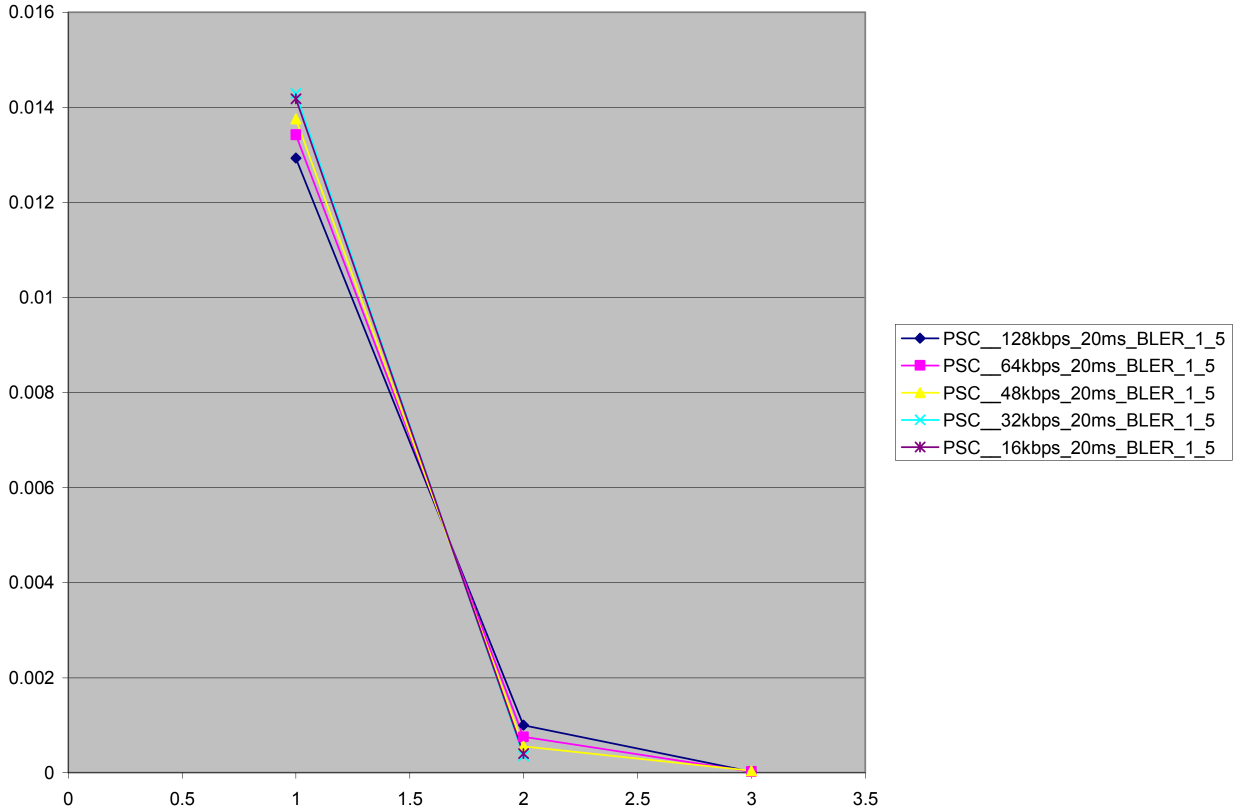

Figure 6 PSC/PSS Burst Error Distribution at 1.5% BLER

2.2 Network simulator for 3GPP packet networks

The network simulator is a modified version of the simulation software developed by VCEG [1] for video applications based on RTP/UDP/IP.

2.2.1 Frame dropping modification

The original simulator required bit error masks, i.e., the sequence of ‘0’ and ‘1’ indicated if a bit was in error or not. The error mask files were also required to be in binary format. An additional feature was added to the simulator enabling it to read ASCII error masks. Its operation was also modified so that the ASCII mask values were interpreted as corresponding to packet losses. Hence, the modified simulator only needs to read one mask for every PDU. If the mask is ‘1”, the PDU is dropped else it is not. When a PDU is in error the RTP packet(s) corresponding to it is(are) dropped (i.e., not written to output file). This operation is shown in Figure 1. As before if the end of file is reached and there are more PDUs to be transmitted, the simulator continues reading from the beginning of the error mask file.

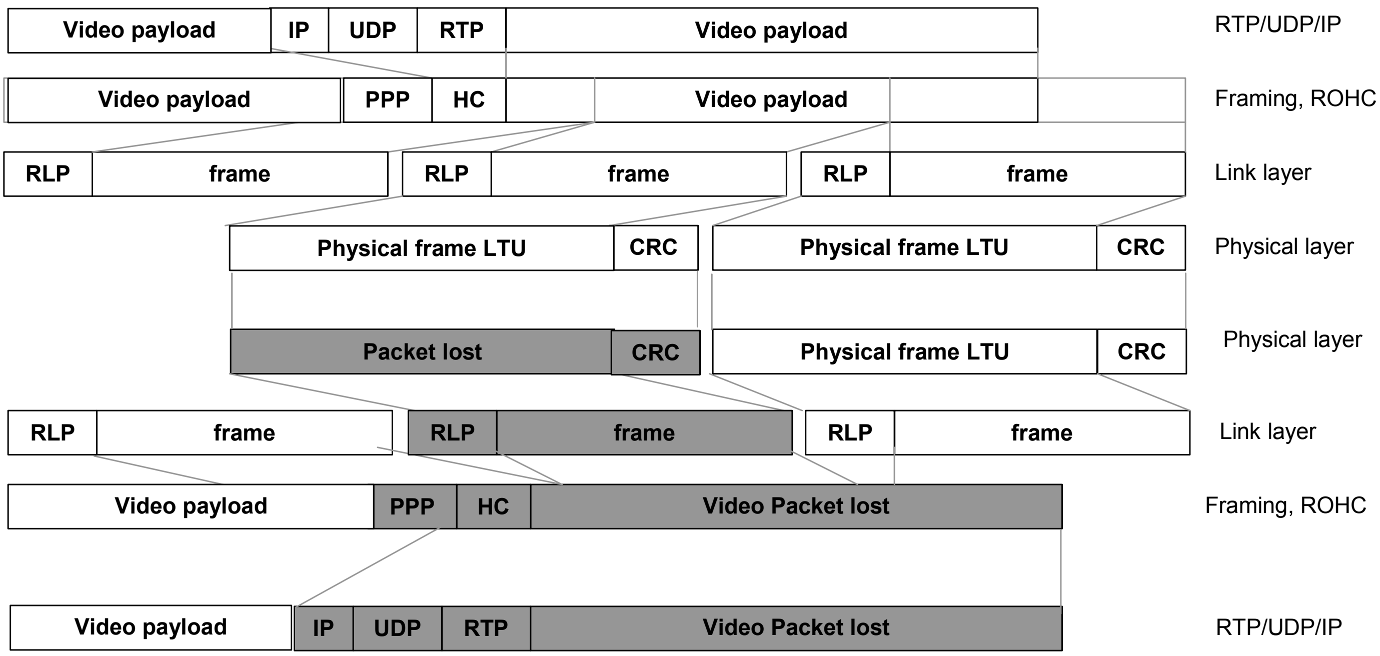

Figure 1 Network simulator operation. The dropped portions of the bitstream at different layers are shown shaded.

2.2.2 Support for Multiple PDU Sizes

For the original simulator only one PDU size needed to be specified. All RTP packets were broken up into these equal size PDUs. In EBR mode of operation a video encoder generates RTP packets corresponding to one of several fixed available PDU sizes [2]. Hence a RTP packet is completely contained in a single PDU. To enable this mode of operation all possible PDU sizes need to be specified

When multiple PDU sizes are specified, each RTP packet is expected to be transmitted in a single PDU. One mask is read for each RTP packet and the smallest PDU that can contain the entire RTP packet is considered lost over the physical layer.

In EBR mode the PDUs themselves provide framing information, hence PPP is not required for EBR. Hence the packet size expansion feature due to PPP has been turned off in the network simulator.

The modified VCEG network simulator is presented in Appendix A.

3 Conclusions

This contribution presents network simulator and packet error masks for characterizing video codecs in 3GPP services. Packet error masks for different conditions were documented. Modifications to VCEG network simulator required to use these error masks were mentioned. Also, the modifications to enable the use of simulator for channels that support multiple PDU sizes were presented.

4 References

[1] VCEG-M77.doc
[2] Tdoc S4-040477, “Video delivery on 3GPP bearers for low delay applications”

Appendix A

The VCEG software simulator along with modifications is included in the attached zip file

Appendix B: Error masks

The attached zip file contains the following error masks

Table 2 List of all error masks

MBMS_128kbps_80ms_BLER_0_5.txt
MBMS_128kbps_80ms_BLER_1_0.txt
MBMS_128kbps_80ms_BLER_1_5.txt
MBMS_16kbps_80ms_BLER_0_5.txt
MBMS_16kbps_80ms_BLER_1_0.txt
MBMS_16kbps_80ms_BLER_1_5.txt
MBMS_32kbps_80ms_BLER_0_5.txt
MBMS_32kbps_80ms_BLER_1_0.txt
MBMS_32kbps_80ms_BLER_1_5.txt
MBMS_48kbps_80ms_BLER_0_5.txt
MBMS_48kbps_80ms_BLER_1_0.txt
MBMS_48kbps_80ms_BLER_1_5.txt
MBMS_64kbps_80ms_BLER_0_5.txt
MBMS_64kbps_80ms_BLER_1_0.txt
MBMS_64kbps_80ms_BLER_1_5.txt
MBMS_64kbps_80ms_BLER_10_.txt
PSC__128kbps_20ms_BLER_0_5.txt
PSC__128kbps_20ms_BLER_1_0.txt
PSC__128kbps_20ms_BLER_1_5.txt
PSC__16kbps_20ms_BLER_0_5.txt
PSC__16kbps_20ms_BLER_1_0.txt
PSC__16kbps_20ms_BLER_1_5.txt
PSC__32kbps_20ms_BLER_0_5.txt
PSC__32kbps_20ms_BLER_1_0.txt
PSC__32kbps_20ms_BLER_1_5.txt
PSC__48kbps_20ms_BLER_0_5.txt
PSC__48kbps_20ms_BLER_1_0.txt
PSC__48kbps_20ms_BLER_1_5.txt
PSC__64kbps_20ms_BLER_0_5.txt
PSC__64kbps_20ms_BLER_1_0.txt
PSC__64kbps_20ms_BLER_1_5.txt

Appendix C: Generation of PDU loss Error Masks

This section presents the methodology used to generate PDU loss error masks.

Modelling Methodology

Frame decoding error events are generated in a link-level simulation. A link-level simulation is run and the decoding successes of each TTI block are recorded in the form of '0' and '1' for each TTI, thereby producing an "error mask". The error mask is then fed into the video simulation to model air interface errors. In those simulations all the bits carried in an application layer packet containing the PDU are discarded when the error mask indicated that the block is in error. This is typically one RTP/UDP/IP packet containing the block that was in error.

The error masks are generated with 16kbps, 32kbps, 48kbps, 64kbps and 128kbps. The MBMS services can be transmitted on physical channel S-CCPCH or DPDCH. The difference between S-CCPCH and DPDCH is given as follows:

- S-CCPCH: No power control is assumed and the Node-B is sending with constant power. Single transport channel mapping is assumed, i.e., all bits on S-CCPCH are used for MBMS. Spreading factor and number of symbols per slot are given in Table 1.

Table 1 S-CCPCH channel parameters

Rate	Spreading Factor	Slot Format	S-CCPCH Bits/80ms TTI
16kbps	128	6	4560
32kbps	64	8	8640
48kbps	32	10	18240
64kbps	32	10	18240
128kbps	16	12	37440

- DPDCH: Both inner loop and outer loop power control are enabled. MBMS services are mapped to DTCH, while signalling messages are sent on DCCH. DTCH and DCCH are physically transmitted on DPDCH. In this simulation it is assumed that DCCH is always present and DCCH rate is 3.4kbps as given in 34.108[1]. Rate matching attributes for DTCH and DCCH are assumed to be the same, in other words, the code rate of DTCH and DCCH are the same.

Table 1 DPDCH channel parameters

Rate	Spreading Factor	DTCH Bits/20ms TTI
16kbps	64	766
32kbps	64	1592
48kbps	32	3861

64kbps	32	3939
128kbps	16	8361

The channel model is case 2 channel from 25.101[2]. The channel profile is given in Table 3.

Table 3 Propagation Channel Models

Case 2, speed 3 km/h	
Relative delay [ns]	Relative mean power [dB]
0	0
976	0
20000	0

Geometry: -3 dB.

- The geometry is the ratio of the average total received power from the cells in the active set to the average of all other received power. The geometry is therefore some measure of the location of the user, in term of C/I.
- -3dB geometry corresponds to greater than 90% cell coverage.

Active set size: 1

- In the case if the user does see more than 1 cell in the active set, selection combining or soft combining can be used to achieve better performance.
- S-CCPCH: the operating Tx power yields 0.5%, 1%, 1.5% and 10% BLER
- DPDCH: Outer-loop target BLER: 0.5%, 1% and 1.5%