TSG-RAN Working Group1 meeting #8
New York, U.S.A., 12th – 15th October 1999

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Agenda Item: **Ad Hoc 4**

Source: **NTT DoCoMo**

Title: **Blind transport format detection performance for AMR**

Document for: **Discussion and Decision**

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1. Introduction

The previous version of AMR speech data format [1], which was specified in TSG SA WG4, included a duplicated number of class A bits in AMR6.7 mode. In the contribution [2], it was suggested that such a duplicated number should be avoided in order to apply the blind transport format detection (BTFD) to UEP scheme of AMR speech transmission. This document discusses the actual BTFD performance according to the possible distance of the number of bits between the two adjacent AMR modes.

2. Performance of BTFD for the two adjacent AMR modes

In this section, the actual performances of BTFD for the two adjacent AMR modes are evaluated by means of the computer simulation. The probabilities of the false transport format detection (this happens if the detected rate is wrong but the CRC misses the error detection) were simulated for the assumed block sizes. The performance comparisons were also done between two BTFD methods: BTFD with relying on only the CRC results and BTFD with relying on both the CRC results and the soft values of Viterbi decoding (this method is corresponding to section A.2 in [3]).

The following simulation conditions were assumed in the simulations:

- Physical channel: downlink format and channel bit rate = 64 kbps (SF = 128)
- Transmitted data rate: 2 rates (i.e. 55 bits and 55 + D bits, D = 1, 2, 3, 4, 5)
- Channel coding: R=1/3 convolutional code with constraint length of 9
- Channel decoding: soft decision Viterbi decoding
- BTFD parameters: CRC party lengths = 8-bit, Viterbi decoding trellis path selection threshold = 1.5 dB
- Interleaving span: 20 ms
- Channel estimation: 2-slot averaging
- Diversity: 2-branch antenna space diversity and 2-finger Rake/branch
- TPC: off
- Channel model: 2-path Rayleigh fading channel with having equal average power per each path

The simulation results are shown in Figure 1. The horizontal axis indicates the bit distance between two adjacent modes and the vertical axis indicates the average false transport format detection probability. The false detection probability performances were simulated for two BTFD cases: BTFD relying on only the CRC and BTFD relying on both the CRC and the soft values of Viterbi decoding. For the former case, it can been seen that almost constant false detection probability are obtained regardless of the bit distance. On the other hand, for the latter case, it is obviously seen that the longer bit distance gives the lower false detection probability.

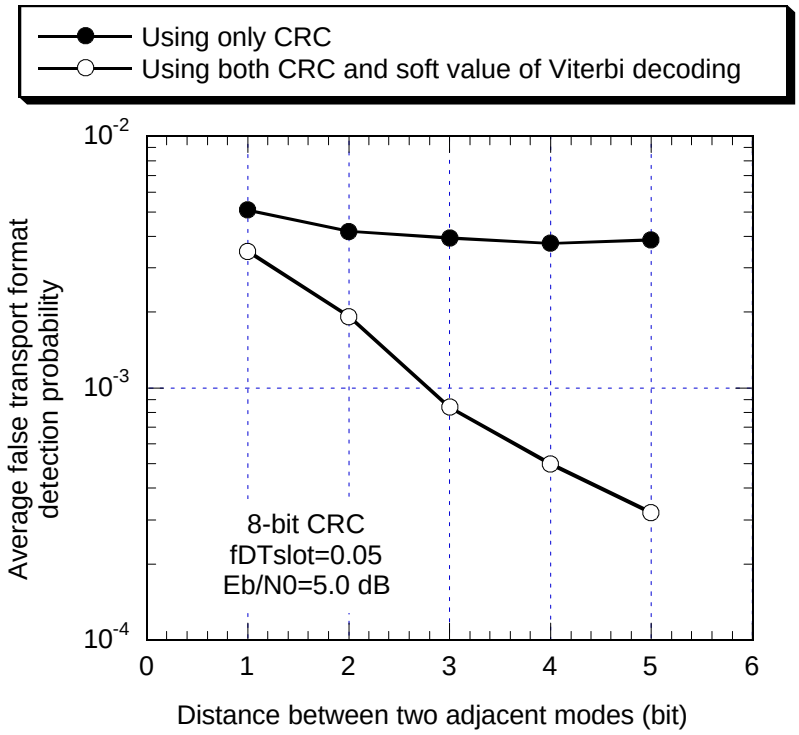

Figure 1 False transport format detection probability performance vs. CRC parity length

3. Optimal bit number of AMR speech data for BTFD

In AMR speech data transmission, BTFD will be performed for class A data basically [2]. From the simulation results in section 2, it can be concluded that for the best possible BTFD performance i.e. the lowest possible false detection probability, there should be a farthest possible distance of the number of class A bits between the two adjacent AMR modes. Therefore, for the AMR6.7 mode, in order to achieve the most reliable BTFD, the bit assignment between the two classes i.e. class-A and –B could be modified in such a way that the three most important bits of class-B are to be reassigned to class-A. This three-bit shift causes equal distances from both upper (AMR7.4) and lower (AMR5.9) adjacent modes, which will give the lowest possible false detection probability. Class-A and -B of the AMR6.7 mode then will have 58 bits and 76 bits respectively (see Table 1).

Table 1 Number of bits in different classes of AMR speech data

Codec Mode	Original format		Proposed format	
	Number of class A bits	Number of class B bits	Number of class A bits	Number of class B bits
AMR12.2	81	103	81	103
AMR10.2	65	99	65	99
AMR7.95	75	84	75	84
AMR7.4	61	87	61	87
AMR6.7	**55**	79	**58**	**76**
AMR5.9	**55**	63	55	63
AMR5.15	49	54	49	54
AMR4.75	39	56	39	56

4. Conclusion

In order to enable the most reliable BTFD, we suggest that R1 ask to S4 for a possible modification on the AMR speech data bit assignment as the above i.e. for AMR6.7, the number of class A and B bits are 58 and 76 respectively.

References

[1] TSG SA WG4, “Mandatory Speech Codec speech processing functions AMR Speech Codec; Frame Structure”, TS 26.101 V1.3.0
[2] NTT DoCoMo, “Blind rate detection for AMR speech transmission”, TSGR1#7(99)c54
[3] TSG RAN WG1, “Multiplexing and channel coding (FDD)”, TS 25.212 V2.2.0