Agenda item:	
Source:	NTT DoCoMo, Nokia, Nortel Networks
Title:	Text proposal for blind rate detection with flexible positions
Document for:	Approval

1. INTRODUCTION

As a result of harmonization [1] and in discussions of the support of some services [2] such as speech [3,4], it was recognized that it would be beneficial to support blind rate detection with flexible positions. This contribution contains a text proposal for modification of TS 25.212 [5].

2. TEXT PROPOSAL FOR MODIFICATION OF 25.212

It is proposed to make the following change to section 4.2.11.2 and to add the Section A.3 below to Appendix A.

4.2.11.2 Downlink

On the downlink, transport data after 2nd interleaving is mapped onto data fields in one DPDCH, which is defined in TS 25.211. If the total bit rate after transport channel multiplexing is not identical to the total channel bit rate of the allocated dedicated physical channels, discontinuous transmission is used.

- If transport data is less than the number of DPDCH bits in a radio frame, the DPDCH transmission can be turn off for data absent.
- The transmission of the DPDCH symbols shall be ON, only if there is data to transmit. If there is no data, the transmission shall be OFF.
- For transport channels not relying on TFCI for transport format detection (blind transport format detection), the positions of the transport channels within the frame should be fixed. <u>In a limited number of cases, where there are a small number of transport format combinations, it is possible to allow flexible positions</u>.
- For transport channels relying on TFCI for transport format detection, the UTRAN decides whether the positions of the transport channels should be fixed or flexible.

Pilot and TPC symbols are always transmitted regardless of the data existence.

Annex A (informative):
Blind transport format detection

A.1 Blind transport format detection using fixed positions

A.1.1 ~~A.1~~ Blind transport format detection using received power ratio

- This method is used for dual transport format case (the possible data rates, 0 and full rate, and only transmitting CRC for full rate).
- The rate detection is done using average received power ratio of DPDCH to DPCCH.
  Pc: Received Power per bit of DPCCH calculated from all pilot and TPC bits per slot over 10ms frame.
  Pd: Received Power per bit of DPDCH calculated from *X* bits per slot over 10ms frame.
  X: the number of DPDCH bits per slot when transport format corresponds to full rate.
  T: Threshold of average received power ratio of DPDCH to DPCCH for rate detection.

If $Pd/Pc > T$ then

"TX_ON"

else

"TX_OFF"

A.1.2 ~~A.2~~ Blind transport format detection using CRC

- This method is used for multiple transport format case (the possible data rates: 0, …, (full rate)/r, …, full rate, and always transmitting CRC for all transport formats).
- At the transmitter, the variable-rate DCH data to be transmitted is block-encoded using a cyclic redundancy check (CRC) and then convolutionally encoded. It is necessary that the CRC parity bits are mapped on the head position (or certain position) in a frame as shown in Figure A-1.
- The receiver knows only the possible transport formats (or the possible end bit position $\{n_{end}\}$ by Layer-3 negotiation (See Figure A-1). The receiver performs Viterbi-decoding on the soft decision sample sequence. The correct trellis path of the Viterbi-decoder ends at the zero state at the correct end bit position.
- Blind rate detection method by using CRC traces back the surviving trellis path ending at the zero state (hypothetical trellis path) at each possible end bit position to recover the data sequence. Each recovered data sequence is then error-detected by CRC and if there is no error, the recovered sequence is declared to be correct.
- The following variable is defined:

$$s(n_{end}) = - 10 \log ((a_0(n_{end}) - a_{min}(n_{end})) / (a_{max}(n_{end}) - a_{min}(n_{end}))) \text{ [dB]} \quad \text{(Eq. 1)}$$

where $a_{max}(n_{end})$ and $a_{min}(n_{end})$ are, respectively, the maximum and minimum path-metric valuse among all survivors at end bit position n_{end}, and $a_0(n_{end})$ is the path-metric value at zero state.

- In order to reduce the probability of false detection (this happens if the selected path is wrong but the CRC misses the error detection), a path selection threshold D is introduced. D determines whether the hypothetical trellis path connected to the zero state should be traced back or not at each end bit position n_{end}. If the hypothetical trellis path connected to the zero state that satisfies

$$s(n_{end}) =< D \quad \text{(Eq. 2)}$$

is found, the path is traced back to recover the frame data, where D is the path selection threshold and a design parameter.

- If more than one end bit positions satisfying Eq. 2 are found, the end bit position which has minimum value of $s(n_{end})$ is declared to be correct.
- If no path satisfying Eq. 2 is found even after all possible end bit positions have been exhausted, the received frame data is declared to be in error.

Figure A-2 shows the procedure of blind transport format detection using CRC.

<Note: CRC moved to the end of the data block.>

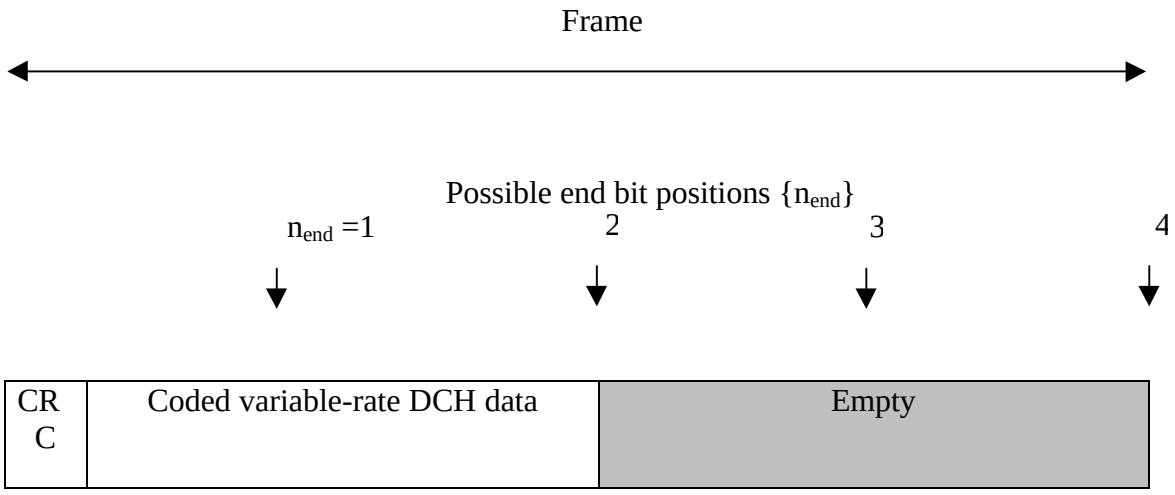

Figure A-1: An example of variable rate data format

(Number of possible transport formats = 4, transmitted end bit position n_{end} = 2)

A.2 Blind transport format detection with flexible positions

In certain cases where the CCtrCH consists of multiple transport channels and a small number of transport format combinations are allowed, it is possible to allow blind transport format detection with flexible positions.

Several examples for how the blind transport format detection with flexible positions might be performed are:

- The blind transport format detection starts at a fixed position and identifies the transport format of the first present transport channel and stops. The position of the other transport channels and their transport formatbeing derived on the basis of the allowed transport format combinations, assuming that there is a one to one relationship between the transport format combination and the transport format of the first present transport channel.
- The blind rate detection evaluates all transport format combinations and picks the most reliable one.

3. REFERENCES

[1] Nokia, Nortel Networks. Proposal for a DL slot structure to support EVRC vocoder, TSG-R WG1 document, TSGR1#7(99)c32, Aug. 30 – Sept. 3, 1999, Hanover, Germany.

[2] Nortel Networks. A modified blind rate detection scheme for improved mapping of some transport format combinations, TSG-R WG1 document, TSGR1#6(99)867, July 13th – 16th, 1999, Espoo, Finland.

[3] NTT DoCoMo. Blind rate detection for AMR speech transmission. TSG-R WG1 document, TSGR1#7(99)c54, Aug. 30 – Sept. 3, 1999, Hanover, Germany.

[4] Nortel Networks. Support of speech in UTRA/FDD. TSG-R WG1 document, TSGR1#6(99)991, July 13th – 16th, 1999, Espoo, Finland.

[5] 3GPP TSG RAN WG1. TS 25.212 - Multiplexing and channel coding (FDD). V2.0.1.