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1. Introduction

This contribution discusses the handling of discontinuous transmission in dedicated channel over the Iur/Iub interface and proposes a solution on how to prevent the transmission of unnecessary FP frames during the non activity period of a dedicated transport channel.

2. Discussion

Dedicated channels may have discontinuous data flow in one or both the directions (as for example a DCH carrying a speech bearer, the signalling Radio Bearer, or any generic NRT data bearer).

In the non activity period, i.e. when no user data is transmitted, two solutions are possible:

A. An **empty data** frame is sent, for every transmission time interval, with the TFI value indicating an transport block set size equal to zero.

B. The transmission is **suspended**, and no frames are sent across the Iub/Iur interface.

Solution B gives sensible benefits in term of transmission efficiency in UTRAN interfaces (possibility to use statistical multiplexing), and allows a reduction of the processing load (every frame is a message that shall be processed in the transmitting and receiving end).

But solution B has a problem that the receiving end cannot tell if a non received data frame is due to the fact that it is has not been transmitted (DTX mode) or due to a transmission error (frame lost or delayed in Iub/Iur). In this case Node B shall assume the TBS size equal to zero in composing the TFCI of the DL radio frame. If the reason was a transmission error in one branch of a soft handover connection, there is mismatch between the radio frame created by this branch and the others, with the consequent failure of the soft combining in the UE (the radio frame could be discarded even if correctly transmitted by one or more RL).

The above mentioned problem does not occur with solution A, because the Node B not receiving a valid FP frame, detect it as a transmission error, and suspend the transmission of the whole radio frame.

The proposal in the next chapter offers a solution how the suspension of the transmission during the non activity period can be done with the possibility for the receiver end to immediately detect transmission errors.

3. Silence detection in Iub/Iur interface

For those DCH characterised by discontinuous transmission, the Iub/Iur FP shall prevent the sending of unnecessary empty FP frames (frame with TFI indication zero bits in the TBS), but it must be ensured that the receiving end does not consider the missed reception of the frame as an transport error, resulting e.g. to incorrect timing adjustments in Iub/Iur DCH FP.

To handle these requirements, two different modes are defined in the receiving side of one FP connection (I.e. in node-B for DL Iub/Iur DCH FP and in SRNC for UL Iub/Iur DCH FP):

1. N*ormal* mode
2. S*ilent* mode.

If a FP frame containing a TBS is not received during a transmission time interval, the receiver shall act according to its mode:

Normal mode: If the receiver in *normal mode* does not receive an expected FP frame, it considers this as a transmission failure. As consequence, the TX-side - when the RX side is not known to be in silent mode - is mandated to send an FP frame for every Transmission time interval, even if the frames do not contain data (empty frame).

Silent Mode: If the RX side in *silent mode* does not receive an expected FP frame, it considers it as an empty frame. Thus the TX-side, when the RX side is known to be in *silent mode,* is not mandated to send empty FP frames.

All kind of frames can be sent both in normal and silent mode.

The FP provides the receiver side a mechanism to signal to the transmitting side the transition between modes as described in the following chapter.

3.1 Transitions between modes

Each DL /UL DCH FP frame contains silence indications, TRANSMIT SILENCE and RECEPTION SILENCE. The former indication is for transmitting direction and the latter for the receiving direction.

When silence detection is not used, both TRANSMIT SILENCE and RECEPTION SILENCE indications are off.

When transmitter (SRNC or Node B) wants to suspend the transmission of empty frames, it sets first the TRANSMIT SILENCE indication ON in all the transmitted frames (empty or non empty frames). When receiver (node-B or SRNC) notices that the indication is set ON then it switches into the silent mode and notify this to transmitter setting the RECEPTION SILENCE indication ON in the frames going to the other direction (empty of non empty frames).

When transmitter notices that the receiver has reacted to the mode change (receives frame(s) with RECEPTION SILENCE indication on), it is not anymore forced to send empty frames.

When the transmitter decides to restore the normal mode (i.e. always transmit a frame in one transmission time interval), it switches the TRANSMIT SILENCE indication off in the transmitted frames. When the receiver in silent mode receives the first frame with TRANSMIT SILENCE indication off, it switches to normal mode, and sets its RECEPTION SILENCE indication off.

4. Proposals

It is proposed that:

- chapter 3 of this contribution is included in a new subchapter in section 8 of [S25.427].
- the TRANSMIT SILENCE and RECEPTION SILENCE bits are included in the structure of the Iur/Iub DCH FP in chapters 7.1.1 and 7.1.2 of [S25.427].

5. References

[S25.427]   3GPP '*Iur/Iub DCH Frame Protocol Specification'*, v.0.1.0. Source: Editor