3GPP TSG-RAN meeting #19 ***RP-030159***
Birmingham, UK, 11 – 14 March, 2003

Source: Ericsson, NTT DoCoMo

Title: Definition of TFCI transmit power on S-CCPCH in case of no data

Agenda item: 8.3.2

Document for: Discussion and decision

---

1 Introduction

At the recent meeting, RAN WG3 has conditionally agreed a CR in [1], specifying the detailed Node B behaviour for the transmission of TFCI for Uu frames in which no data are to be transmitted to any user on the data field of the S-CCPCH. A particular formula was specified to define the transmit power of the TFCI bits for this case with the goal to ensure coverage of the cell with TFCI bits in such a situation.

When the issue was discussed during RAN1#31 and RAN3#34, concerns were stated from several companies about the necessity of specifying this particular Node B implementation aspect, as well as concerns on the usefulness of the proposed formula.

2 Unspecified behaviour

On the S-CCPCH, the physical channel carrying the FACH and PCH transport channels, transport format combination indicators (TFCI) can be included in the slot format, resulting in a number of coded TFCI bits transmitted in every slot of the S-CCPCH frame (see Figure 1). Today, the transmit power of the TFCI bits in case of no data being scheduled on any of the transport channels multiplexed into the S-CCPCH, is not specified in detail. This means, that current Node B implementations may or may not transmit the TFCI bits in case that no data are scheduled on the S-CCPCH.

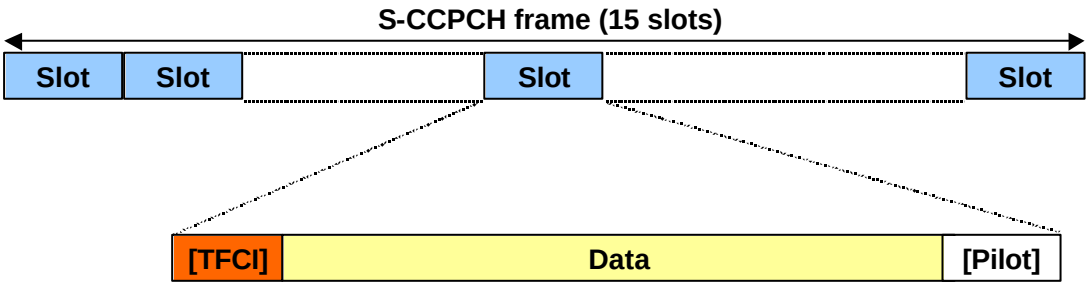

Figure 1: S-CCPCH frame structure

For DPCH transmission, a detailed specification of the transmission power for the TFCI bits from the Node B is needed, because proper operation in SHO needs to be assured to consider soft combining of TFCI bits received from several Node Bs. However, since there is no SHO applicable to S-CCPCH, there is no such need to specify the Node B behaviour in detail.

2.1 Coverage of TFCI in the cell

For the S-CCPCH, the TFCI bits need only to be correctly received by those UEs that are scheduled to receive data on the S-CCPCH. Power setting on S-CCPCH allows to vary the transmit power per transport

channel, resulting in potentially different coverage areas of the cell. The transmit power of the TFCI bits is relative to the transmit power of the S-CCPCH data parts (see Figure 2a).

Since the intention of the TFCI is to indicate the transport format of the data for the decoding process, it is only necessary for correct system operation to provide coverage for the TFCI at the same areas that are covered by the data. For the case of no data, there is no reason to transmit the TFCI over the whole or parts of the cell and a UE implementation has to be prepared to handle such cases.

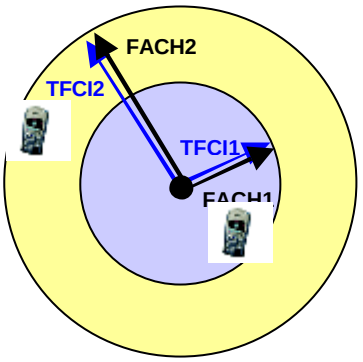

Figure 2: Cell coverage for FACH and TFCI using variable FACH power levels

2.2 System operation with unspecified TFCI transmit power in case of no data

As discussed in the previous section, the Node B behaviour in case of no data being scheduled on the S-CCPCH is not specified in detail with respect to the TFCI transmit power. However, as we have shown in the discussion above, this is not critical for the system operation, and a UE implementation has to be prepared to handle this case.

Therefore we conclude that the system operation is not affected, regardless whether the Node B transmits the TFCI bits in case of no data or not.

3 Terminal power saving

The benefit claimed for the proposal in [1] is some gain in terminal power saving, assuming that the UE needs to get explicit TFCI information for the case of no data on S-CCPCH in order to be able to skip the decoding of the S-CCPCH data part. Whether the UE can actually get a significant power saving from the fact of the TFCI bits being transmitted, has not been discussed in RAN1 or RAN4, and has not been motivated when the proposed CR was presented in RAN1 and RAN3.

For every S-CCPCH frame [Figure 1], the UE has to perform the following steps:

- ?? receive the whole frame
- ?? despread the whole frame
- ?? buffer the soft bits
- ?? extract and decode the TFCI bits after all 15 slots have been received
- ?? decide whether to decode the data bits or not.

As it can be seen from the UE operation, the UE is not able to switch off the whole receiver during parts of the frame, which in our view would be required to significantly save power. The expected amount of potential terminal power saving is therefore negligible.

Note that it is not possible for the UE to just read a few slots, make a quick decision on the TFCI and shut down the receiver, as this would largely degrade the TFCI detection performance.

4 Conclusion

Following from the discussion above, we see no issues with respect to system operation that would require specifying a detailed Node B behaviour for the transmit power of the TFCI bits in frames where no data are transmitted on the S-CCPCH.

In addition, the benefit in UE power consumption coming from the transmission of the TFCI bits from the Node B in case of no data is negligible and comes at the cost of transmitting TFCI bits over the whole cell.

Therefore, we recommend not to approve the CR in [1], which mandates a particular transmit power of the TFCI bits.

If it is seen desirable to investigate terminal power saving by transmission of TFCI bits on the S-CCPCH in case of no data, the improvements in terminal power saving should be studied and weighted against the cost of transmitting the TFCI bits over the whole cell on the air interface. A study item covering this topic is already existing in RAN.

5 References

[1] R3-030356, “CR 25.435-095r2 (Rel5) : S-CCPCH power setting in case of no data transmission”, Alcatel