TSG-RAN Working Group 1 (Radio L1) meeting #14 ***R1-00-0845***
Oulu, Finland, 4th July – 7th July 2000

Agenda Item: 5

Source: Motorola

Title: Proposed change to UE capabilities relating to compressed mode by spreading factor reduction

Document for: Discussion / Decision

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1 Introduction

This document looks at the impact of compressed mode by spreading factor reduction for higher data rate services and proposes a change to TR25.926 (UE Radio Access Capabilities).

2 Impact of compressed mode by spreading factor reduction for higher data rate services

At RAN1#13 there was discussion of the UE capability parameter, 'maximum number of physical channel bits received in any 10ms interval' in relation to compressed mode by spreading factor reduction. The conclusion of the discussion was that the number of bits in a compressed frame would be the same or less than the number of bits in a non-compressed frame and so the size of the 2nd interleaver is not affected. Consequently no change was made to the UE capability definition.

However, the discussions at RAN1#13 did not fully consider all the potential impacts of compressed mode by spreading factor reduction particular for higher data rate services. These are:

- Impact on the rake receiver due to the fact that the instantaneous symbol rate is doubled during the compressed half of the frame. One impact of doubling the instantaneous symbol rate is a doubling of the memory requirements in the rake receiver. The channel estimate obtained from the CPICH is filtered over a number of CPICH symbols received both before and after a data symbol that is to be demodulated. This means that data symbols must be buffered before they can be demodulated and any increase in the instantaneous symbol rate will therefore impact the memory requirement. For lower data rate services this is not an big issue, but becomes more critical for higher data rate services.

- For high data rate services compressed mode by higher layer scheduling is a more attractive compressed mode method for power management reasons. Compressed mode by spreading factor reduction requires a power delta to be applied to the compressed part of the frame and this is particularly undesirable for a high data rate services that are already at a high power. On the contrary compressed mode by higher layer scheduling would require no such power delta for these high rate services.

- High data rate services are likely to be packet switched such that the buffering of data due to compressed frames is not a problem. Therefore compressed mode by higher layer scheduling is an appropriate method for higher data rate services.

Considering the impact on UE complexity, this contribution proposes to alter the definition of this UE capability parameter so that it includes the impact of compressed mode by SF reduction. To ensure that any changes to the definition would not cause all the UE capability values to be altered, the proposed change to the definition only applies for the parameter values of 14400 bits and above so will only affect the 384 kbit/s class and above.

The implication of this would be, for example, a UE of the 384 kbit/s class that declares that it can support 19200 bits per 10ms would not have to support compressed mode by SF reduction for the case of 2 multi-codes of SF 8, or 3 codes of SF 16, etc. For these cases, one of the other compressed mode methods would have to be used. This is not a new restriction as it already exists for the case of a single code at spreading factor 4.

3 Proposed change to definition

Proposed change to the definition of the UE capability parameter, 'Maximum number of physical channel bits received in any 10ms interval (DPCH, PDSCH, S-CCPCH)':

Extract from 25.926

Defines the number of physical channel bits the UE is capable of receiving. For DPCH in soft/softer handover, each DPCH is only calculated once in this capability. The number of DPCH channel bits indicates the capability for normal, un-compressed mode.

The parameter also indicates the capability of the UE to support compressed mode by spreading factor reduction. For parameter values up to and including 9600 bits, t~~T~~he UE shall also be able to support compressed mode by SF reduction when operating at any value up to the reported capability. ~~this value.~~ For parameter values greater than 9600 bits, the UE shall be able to support compressed mode by spreading factor reduction when operating at any value up to half the reported capability or 9600bits, whichever is greater.

End of extract from 25.926

Examples of the implication of this definition for different parameter values:

1. A UE declares that it can support 9600 bits -> This UE shall be able to support compressed mode by spreading factor reduction for a single code of SF 8 (9600 bits).
2. A UE declares that it can support 14400 bits -> This UE shall be able to support compressed mode by spreading reduction for a single code of SF 8 (9600 bits), but would not have to support compressed mode by spreading factor reduction for 3 codes of SF 16 (14400) bits.
3. A UE declares that it can support 19200 bits -> This UE shall be able to support compressed mode by spreading reduction for a single code of SF 8 (9600 bits), but would not have to support compressed mode by spreading factor reduction for 3 codes of SF 16 (14400) bits, 2 codes of SF 8 (19200) bits.

Also it is noted that this change to the definition does not impact any of the inter-operability configurations contained within the ISG document. The 384kbit/s services are mapped to a single code of spreading factor 8 and with this proposed change a single code of spreading factor 8 would still be able to support compressed mode by spreading factor reduction. Also, the 2Mbit/s services are mapped to spreading factor 4 codes for which compressed mode by spreading factor reduction is not defined.

4 Conclusion

This contribution discussed the impact of compressed mode by spreading factor reduction on the complexity of terminals supporting high data rate services. As a result of this complexity it is proposed to alter the definition of the UE capability parameter 'maximum number of physical channel bits received in 10 ms'. The change means that for some high rate service mappings compressed mode by spreading factor reduction could not be used. This is not a new restriction as it already applies to any services mapped to spreading factor 4. The change to the definition does not impact any of the lower terminal classes and does also does not impact any of the inter-operability configurations in the ISG document.