3GPP TSG-RAN WG1#8
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Agenda Item: Adhoc 4 / (Adhoc 11?)

Source: Nokia

Title: Proposed Physical Layer Service Implementation Capabilities for AMR to be included in T2 report

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1. Introduction

In last WG1 meeting a liaison statement was sent to T2, containing a proposal for physical layer implementation capabilities for support of the default speech service and of CS data services up to 64 kbps. Here we try to further improve the contents of T2 report.

Our proposal is to split the table into two tables, a) one for AMR and b) one for CS data services up to 64 kbps, since in that way it is easier to define the capabilities clearly. Further, we propose that we specifically define that the requirements are for AMR service, so they are not the requirements that are valid for supporting all the possible speech codecs. For other possible speech codecs, there has to be a separate physical layer service implementation capabilities table, since the requirements might also be different.

This contribution includes the proposed table to be included for T2 report for AMR. The basis has been the table 8 from TR 21.904, v. 0.0.4 from T2, "Terminal capability requirements". The corresponding proposal for CS data up to 64 kbps can be found from a separate contribution from Nokia.

2. Comments to the contents of the table

Here are some explanatory comments to certain parts of the table.

Error detection: For error detection, it has been identified that at minimum 12 bits CRC is needed to ensure good performance with BRD. However, it should be possible for the network operator to use also 0, 8 or 16 bit CRCs, if desired.

Channel coding: convolutional coding has been seen to give adequate performance.

Multiplexing:

- **UEP:** In last WG1 meeting there seemed to be a consensus that UEP, unequal protection, is shown to give performance gain for AMR transmission. Thus we propose that all UEs should support at minimum 4 transport channels both in uplink and downlink, of which 1-3 transport channels is reserved for AMR and 1 for dedicated signaling channel.

- **# of transport channels higher than 4 ?:** In last WG1 meeting there was one proposal from Nortel, that the number of transport channels in the transport format combination set could be higher than the maximum number of transport channels in one frame. In that way the coding could be optimised for different AMR modes, by having different transport channels carrying the same bit class in different modes. (e.g. TrCH1 would carry class A at 12.2 k mode and TrCh5 would carry class A at 7.95 k mode). In this way the coding could be changed when changing the mode. The decision on whether this is allowable, should come from WG2, since they might be more worried about this than WG1. Until we get the acceptance from WG2, the working assumption should be that the minimum requirement is that up to 4 transport channels are supported by all terminals.

- **transmission of mode command bits:** Within WCDMA, the main purpose of changing the AMR mode is slow adaptation to the capacity limited situation in downlink, or capacity or coverage limited situation in uplink. The adaptation by changing the mode, will be very slow, since outer loop and inner loop power control will take care of the fast adaptation in WCDMA.

For downlink mode changes it is clear that the mode can be indicated by TFCI or BRD. The main question is how to send so called mode commands from RNC to UE, where RNC commands the UE to change the mode in uplink. For the slow adaptation rate in WCDMA, there has been some ideas that L3 signaling could be used.

The possible case where the mode commands should be sent very fast from RNC to UE is , when we have TFO (tandem free operation) connection between UMTS and GSM, so called UE - MS connection. Since in GSM the mode adaptation can be very dynamic, sending the mode commands fast from RNC to UE has to be possible then also in WCDMA. There has been some comments that in that case, one additional transport channel is needed for sending these mode commands in downlink.

This issue should be discussed with separate contributions, and the table in T2 report should be updated accordingly, after a consensus has been reached. Until then, the working assumption should be that at minimum 4 transport channels is required for AMR transmission. Otherwise it is not possible to define clearly what is the status of WG1 *at the moment* for this issue.

- **TTI:** Support of TTI=20 ms for each transport channel has to be mandatory for all terminals.

Transport format detection :

- **TFCI or BRD:** The support of transport format detection with TFCI has to be mandatory for all terminals both with fixed and flexible TrCH case. However the support of blind transport format detection with flexible position case is not possible with the present rate matching algorithm. On the other hand there is no point to require blind transport format detection with fixed positions at SF=256, because then there is no possibility to fit signaling together with AMR. This means that the only possible case where the support of Blind transport format detection can be required at the moment is SF=128 with fixed positions. Thus the *present status* is suggested to be included to T2 report.

- **Number of transport formats to be supported:** All 8 AMR modes should be supported + 1 mode for SID frames + 1 mode for DTX. For dedicated signaling channel there should be possibility for 2 modes, e.g. on / off. This will mean totally : 2*(8+1+1)=20 transport format combinations.

3. Proposed table for AMR to be included in liaison to T2

Table 1. FDD mode Physical Layer Service implementation capabilities for support of ~~the default~~AMR speech service ~~and of CS data services up to 64 kbps~~

Service Implementation Capability	Specification	Section(s)[1]	Comments
Physical Layer UE procedures and measurements:			
Handover	25.215 25.212	6.1.1, 6.1.4, 6.1.5, 6.1.9, 7.1.1.2, 7.1.2, 7.1.3 4.4	Support of soft handover is mandatory for all terminals ~~supporting CS services~~. Support of Inter-Frequency handover is mandatory for all terminals. Support of intra-frequency hard handover is FFS. Terminals shall support measurements commensurate with their mode/system capabilities, to facilitate inter-frequency, inter-mode & inter-system handover.
Power control	25.214 25.215	5.1.2, 5.2.3 6.1.1, 6.1.3, 6.1.6, 6.1.7	Support of closed loop power control is mandatory for all terminals.
Error detection	25.212	4.2.1	Support of 0, 8, 12 and 16 bits CRC per transport block is mandatory for all terminals.

[1] The list of references to the 25.2 series should not be considered exhaustive. References will need to be refined and updated as the standard is further elaborated.

~~Multiplexing and~~ Channel Coding	25.212	4.2.3.~~2~~, ~~4.2.4 – 4.2.15, 4.3~~	~~Turbo coding to be used for BER requirement of less than 10^{-3}.~~ Support of no coding and convolutional coding with rates ½ and 1/3 is mandatory for all terminals.
Multiplexing	25.212	4.2.4 - 4.2.14	In single service case, with only AMR and dedicated signaling channel, it is mandatory for all terminals to support at minimum 4 transport channels both in uplink and downlink, of which 1-3 is reserved for AMR and 1 for dedicated signaling. < This is a working assumption, since it is still FFS whether there could be more than 4 transport channels in the transport format combination set, so that different coding can be applied to the Bit classes in different modes. The decision for this should come from WG2, whether that is allowable.> It is still FFS whether mode command bits in downlink will need an additional transport channel or not. Support of TTI=20 ms for each transport channel is mandatory for all terminals.
Transport format detection	25.212	4.2.15	In downlink, the support of transport format detection with TFCI is mandatory for all terminals both with fixed and flexible TrCH positions. In downlink, when SF=128 and fixed TrCH positions is used in the single service case, with only AMR and dedicated signaling channel, the support of blind transport format detection is mandatory for all terminals. In the single service case, with only AMR and dedicated signaling channel, it is mandatory for all terminals to support at minimum 2*(8+1+1)=20 transport format combinations during the connection, of which 8 is reserved for AMR modes, 1 for SID frame, 1 for DTX and the multiplication of 2 is due to dedicated signaling channel having two possible rates (e.g. on/off).
Modulation	25.213	4.4.3	

Spreading and Scrambling Code Generation	25.213	4.3	For the single service case, with only AMR and dedicated signaling channel, it is mandatory for all terminals to support SF=128 and SF=256 in downlink, and SF=256…64 in uplink. In multiple service case the required spreading factor depends on the data rates of the services to be supported simultaneously. ~~Required Spreading Factor is dependent on channel coding rate, and on whether services are to be supported simultaneously. Terminals shall support all spreading factors between the maximum (256) and minimum (SFs of 16 & 64 are required for support of individual 64 kbps and 16 kbps services respectively). There is no specified manner for mapping given data rates to physical channels. That function is performed in Layer 2/3.~~
Code de-spreading and de-scrambling	25.213	5.2	
Support for downlink Transmit Diversity	25.211 25.214	5.3.2 8	Support of ~~feedback mode~~open loop and closed loop transmit diversity is mandatory ~~in~~ for all ~~T~~terminals. ~~supporting dedicated channels.~~
Support for Site Selection Diversity Transmission	25.214	5.3.2.4	Support of SSDT is mandatory for all terminals ~~supporting soft handover~~.
Transport channels required:			
Dedicated channel (DCH)	25.211	4.1.1, 6	
Physical channels required:			
Dedicated Physical Data Channel (DPDCH)	25.211	5.2.1, 5.3.2, 6	
Dedicated Physical Control Channel (DPCCH)	25.211	5.2.1, 5.3.2, 6	