Agenda Item	**:**	AMR Adaptation
Source	**:**	Nortel Networks[1]
Title	**:**	AMR modes for the UTRA-FDD
Document for	**:**	Discussion

1. Introduction

The AMR speech codec includes eight speech modes and a dedicated mode used for voice controlled rate (also known as VAD/DTX in GSM). Regarding this latter there can be more dedicated modes for voice controlled rate since there are options to support the SID frames of different 2G codecs, i.e. GSM EFR, IS-136 EFRC and PDC EFR (6.7 kbit/s option) which correspond to different modes of the AMR (i.e. 12.2, 7.4 and 6.7).

The purpose of this contribution is to clarify whether all the modes are always going to be supported or not. This has side impact on different aspects such as the TFO or the Spreading factor to be used.

A more general question is raised : What is the flexibility left to the operator regarding the configuration of the basic speech service ?

2. Restrictions of the number of modes

We have identified at least two reasons why it could be decided to restrict the number of modes of the AMR. There might be more.

2.1 DL Spreading Factors

The SF has an obvious influence on the available net bit rate to transmit data over the radio interface. The SF in DL has also an impact on the number of codes that can be used in DL due to the tree structure of the spreading codes. It is therefore important to avoid code shortage to use as far as possible the largest SF. In UTRA-FDD this corresponds to the SF 256, SF512 not being possible for soft handover.

The SF 256 can be used for the AMR source bit-rates 7.95 kbit/s and downward and consequently cannot be used for the 10.2 and 12.2 kbit/s modes.

The issue in DL is that contrarily to the UL the SF cannot be easily changed and if SF 256 is selected, in order to avoid code shortage, two modes as previously shown cannot be used.

2.2 Number of TFCI codes

The 3G terminals will offer in principle many more services than speech only. These services which are mainly data services could be used simultaneously with the basic speech service. This will potentially create a number of combinations that will be difficult to handle with the 6 bits of the normal TFCI.

There's of course the possibility to use the extended TFCI that offers more combinations (1024) but which has less redundancy. It might be preferred to use fewer modes of the AMR codes in order to free code points and avoid the use of the extended TFCI

3. Voice Controlled Rates

The use of Voice Controlled Rate reduces the interference level since when the talker is inactive a SID frame is transmitted every 160 ms and nothing in between.

However it is questionable whether it will be systematically used. This feature known as DTX in the 2G systems is explicitly enabled by the operator. It could be reasonable to think that the same would apply for UTRA.

In this case we can see that the number of modes of the AMR is reduced by one or more if the SID frame formats alternatives are considered.

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[1] Contact persons : Frédéric Gabin, William Navarro, Evelyne Le Strat, Catherine Leretaille

4. Configuration of the AMR

The UTRAN receives at call set-up or during the call from the CN the list of RABs with their corresponding information such as bit-rate, QoS, TTI, etc.

If the number of modes is to be reduced it is assumed that this would be done through this procedure. However the CN is not supposed to know about the details of the radio interface which can be the reason why restricting the number of modes. For example the CN does not know about the SF to be used in DL. The Iu interface is supposed to be almost the same for UTRA-FDD and UTRA-TDD and a same CN could be connected to both of them. Will the CN apply restrictions to both although the reasons for restricting it are dependent on only one of the two ?

An important question is to know whether the CN will always know the restriction that apply to the number of active modes of the AMR. In our understanding for example the limitation to the SF 256 is known by the SRNC but at the moment the SRNC does not indicate this to the CN.

5. Impact on TFO and TrFO

The GSM AMR TFO is about to be completed. The Transcoder Free Operation (TrFO) is being defined by the TSG CN.

During the development of the GSM AMR TFO a difficulty was to handle the so called Active Codec Set (ACS) and Supported Codec Set (SCS). The ACS indicates which modes of the AMR can be used. In GSM up to 4 modes only can be used for a call unless the ACS is modified. The SCS indicates what are the modes that could be possibly used, it indicates the ACS but also other modes that can be used to change the ACS.

In the context of the UTRA we understand that if restrictions apply there might be similar sets. It is however not clear that a SCS would be needed.

S4 is about to start the development of the UMTS TFO which is assumed to be an evolution of a the GSM TFO which takes into account the specificity of the UTRA. It will also be interoperable with the GSM TFO which will be evolved together.

The Transcoder (TC) has a very important role in TFO. It needs to know the configuration of the speech service and in particular the configuration of the AMR in order to signal it to the distant TC. The TC in the case of the UMTS is part of the CN. Therefore if restrictions apply in the number of modes which can be used, this should be known by the TC.

The out-of-band signalling (ITU-T BICC) used for TrFO should include similar information fields and therefore the points emphasized for the TFO are also valid for TrFO.

6. Conclusion

This documents have presented reasons why there could be a restriction on the number of modes of the AMR which can be used.

Our analysis tends to show that it would be unavoidable although the UE, Node B, RNC and TC are able to support all the modes. This has not been explicitly stated so far. This has some impacts and may require that signalling be designed to inform the CN.

A more basic question is whether flexibility will be left to the operator in configuring the AMR as it is done in GSM. This question is out of the scope of this joint R1-S4 meeting, TSG-SA, possibly the S1 WG, should be the right committee but this would have an impact on the work of S4 and possibly R1 since some hypothesis would have to be reconsidered.