3GPP TSG-SA Codec Working Group

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Source: **Ericsson**

Title: **Use of AMR 12.2 in EFR applications**

Document for: **Discussion and Decision**

Agenda Item:

From an interoperability and quality point of view, it is possible to use the AMR 12.2 kbit/s mode as an EFR coder. At present there is no information in the specifications on how this should be accomplished. This document proposes priciples for how this implementation can be done and which specifications would be affected.

1. Background

The 12.2 kbit/s speech codec mode of AMR is functionally identical to the GSM EFR codec. The two speech codecs do not produce bit-exact outputs, but they are interoperable (the output from one encoder can be input to the other decoder with retained quality). The differences between AMR and EFR are briefly summarised below.

AMR 12.2 has 5 ms longer delay than GSM EFR which is caused by the (dummy) look-ahead of 5 ms (added to allow seamless frame-wise mode switching with the rest of the AMR modes).

AMR 12.2 includes corrections to known bugs in the GSM EFR code. These corrections do not affect interoperability.

AMR 12.2 uses a different VAD/DTX/CNG scheme than EFR. This is ofcourse a significant difference between the two codecs.

Allowing the use of the AMR coder as an EFR coder will result in more cost efficient terminal implementations.

2. Principle of change

The most straightforward approach is to define an alternative GSM EFR implementation, which is using the bit-exact AMR 12.2 speech codec mode (AMR mode locked to 12.2 kbit/s). This would mean that a 5 ms additional delay is introduced for EFR. The delay of this EFR implementation would be identical to that of GSM AMR. Allowing this delay would significantly simplify the required changes and minimise the proliferation of compatible but non-identical AMR versions.

The AMR DTX system should be modified to use the EFR SID update rate and SID encoding (i.e. the comfort noise generation of EFR). A GSM EFR encoder/decoder implementation according to this AMR-EFR specification must meet the encoder/decoder test vectors of AMR 12.2, except for the DTX test sequences (DTX01.* - DTX07.*). New test vectors should be derived for DTX operation.

3. Affected specifications

The following GSM specifications are affected.

GSM 06.51	CR (additional text) to EFR General Description to indicate that AMR 12.2 is a valid alternative GSM EFR implementation. The description will point to the complete set of AMR specifications, except for the DTX and CNG which should be implemented in accordance with the EFR specification. This CR has already been provided for S4/SMG11.
GSM 06.54	CR (addition text and additional vectors) to the GSM EFR test vectors for DTX for the case of AMR 12.2 using GSM EFR DTX/CN. This addition would allow implementors to verify performance. In principle it is not required since the the basis for the code changes is available in the AMR and EFR C-codes. However, it is suggested to be added to ensure proper operation.

Optionally the following specification may be updated.

GSM 06.73	CR (additional text and additional code) to the AMR C-code to include also the EFR DTX/CN scheme. Implementors can derive the correct reference C-code from the corresponding EFR and AMR reference C-codes, hence this change is not required.

4. Conclusion

It is proposed to update the EFR specifications to allow implementations using the bit-exact AMR 12.2 kbit/s mode with a modified DTX and CNG system. If the general principle for this update is accepted, new test vectors for DTX can be provided by Ericsson.