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**3GPP TSG-SA4 Meeting #22**  
**Tampere, Finland, 22-26 July 2002.**

**Tdoc S4-020481**

**Title:** LS on Allowed AMR-WB Configurations  
**Response to:** -  
**Release:** REL-5  
**Work Item:** AMRWB

**Source:** SA4  
**To:** SA, GERAN, RAN, CN, T  
**Cc:**

**Contact Person:**

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**Attachments:** S4-020393

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**1. Overall Description:**

During its Tampere meeting (22-26 July 2002) SA4 discussed again the aspects of AMR-WB speech telephony services, considering especially the interworking between 2G and 3G core networks with GERAN and UTRAN access. The goal was to further simplify the handling within the RAN and CN for call setup and handover, especially at the inter-RAN handovers.

As a consequence of the discussion it is proposed to reduce the allowed Configurations for AMR-WB speech telephony to exactly three (see also attached S4-020393):

Configuration A: 6,60 / 8,85 / 12,65 kbps.  
Configuration B: 6,60 / 8,85 / 12,65 / 15,85 kbps.  
Configuration C: 6,60 / 8,85 / 12,65 / 23,85 kbps.

These configurations are per design always TFO/TrFO compatible and by this minimise the need for RAB and bearer modifications.

Configuration D (6,60 / 8,85 / 12,65 / 15,85 / 23,85) was deleted from the list of allowed configurations, because it is not compatible to any of the other three (mode 6,60 kbps is missing).

SA4 already took the actions and prepared the necessary CRs for all relevant Technical Specifications under SA4 responsibility.

**2. Actions:**

**To SA and GERAN**

**ACTION:** SA4 would like to ask SA to consider and approve this proposal for REL-5.

**To RAN, GERAN, CN, T groups**

**ACTION:** SA4 would like to ask all RAN, GERAN, CN, and T groups to consider the new proposal on simplification of AMR-WB speech telephony service and take the actions to incorporate the necessary changes into the Technical Specification under their responsibility (REL-5).

**3. Date of Next TSG-SA4 Meetings:**

TSG-SA4 Meeting #23	30 <sup>th</sup> September – 4 <sup>th</sup> October 2002	Montreal, Canada.
TSG-SA4 Meeting #24	11 <sup>th</sup> – 15 <sup>th</sup> November 2002	Reading, U.K.

**Source:** Ericsson<sup>1</sup>  
**Title:** Allowed AMR-WB Configurations  
**Agenda Item:** 13.1  
**Document for:** Discussion and Approval

## Proposal

It is proposed to restrict the allowed configurations for AMR-WB speech telephony to exactly three, rate-control-compatible configurations (0, 2, 4), see Table 1:

**Table 1: Allowed Configurations for the Adaptive Multi-Rate – Wideband Codec Types**

Configuration → ↓ Codec Mode	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
23,85					1											
15,85			1													
12,65	1		1		1											
8,85	1		1		1											
6,60	1		1		1											
FR_AMR-WB, OHR_AMR-WB	Y															
OFR_AMR-WB, UMTS_AMR-WB	Y		Y		Y											

The “1” in Table 1 indicates that the corresponding Codec Mode is included in the Configuration. The three lower modes and SCR (==DTX) shall be mandatory in all Configurations.

The “Y” in the table indicates, which Configuration is defined for which Codec Type.

The Configurations shall be mandatory for all mobiles that offer the corresponding Codec Type.

AMR-WB is optional for all Radio Access Technologies (RATs), but if AMR-WB is offered, then Configuration 0 shall be mandatory for all RATs that offer AMR-WB speech telephony, while Configurations 2 and 4 may remain optional.

Means shall be provided for the core network to identify which of the optional Configuration is supported by the RAT.

These specifications shall be reflected as mandatory/optional in TS 26.103, REL-5, and the consequences shall be incorporated into all necessary TSs by T, RAN, GERAN and CN.

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## Argumentation

### General

In modern multi-operator, multi-vendor and multi-RAT networks extreme focus must be given to interoperability and reliability.

The AMR-WB shall be seen as one coding algorithm with several integrated codec modes and integrated source controlled rate decision (SCR=DTX). The flexibility offered by the Adaptive Multi Rate concept is important to react quickly on the changing mobile environment, to achieve always best possible speech quality.

AMR-WB differs from any other speech codec type in 3GPP in the sense that a transparent digital channel is essential from mobile to mobile. This can be provided by TFO, by TrFO or by IMS. It always requires that both mobiles and the whole path in between must be kept compatible in all call setup and handover scenarios.

If too many, not compatible configurations are allowed, then the handling of the call on all protocol and transport levels will be (extremely) difficult, with potential breaks in the speech path, while the gain in speech quality or network capacity is not obvious.

### History

During the SA4 meeting in Lulea the number of modes for AMR-WB speech telephony has been reduced from nine to five, in order to save implementation and testing complexity. In Rennes it was further agreed to promote only a limited number of combinations of these codec modes (the configurations) for mobile terminal conformance testing.

This document goes another step forward and proposes to limit the number of allowed AMR-WB configurations to as few as possible. This is the real step for complexity reduction and increased reliability and compatibility, not only for terminals and base stations, but also for the core network.

### Complexity and Testability for Mobiles

The proposal does not change the implementation complexity in mobiles compared to the current agreement. But it exactly defines, which configurations need to be considered and tested. The number of Configurations is small enough to define and perform an exhaustive, full conformance test. This offers a substantial improvement potential for reliability and network compatibility.

### Complexity for Radio Access Networks

The implementation complexity differs little when going from one Codec Mode to three, because the channel coding is based on similar algorithms for all modes.

What comes in addition is the rate-control or link-adaptation algorithm.

This in turn has two aspects: the rate-control protocol and the rate decision algorithm.

The rate control protocol shall be mandatory for all RATs, i.e. a rate control command received from the distant side via the core network shall always be obeyed and transferred to the mobile.

The rate control decision is, however, a local RAT issue and may be more or less elaborated.

In summary the additional complexity by mandating configuration 0 (all three lower modes) for all RATs is not an undue burden, compared to the gain in across-network-compatibility and simplification in call handling. Intra-RAT handover simplifies substantially.

### Complexity for Core Network

For the core network the complexity of TFO and TrFO negotiation collapses dramatically to a

simple scheme, because now at least three modes are always present and guarantee a high degree of speech quality, even under varying radio conditions. The maximum rate control will always guarantee best possible speech quality in all combinations.

Inter-system handovers and handovers in not perfectly homogenous networks do not force mid-call-modifications for the whole TrFO-path. The TFO/TrFO decisions are then trivial.

### Discussion of Configurations

The main and “anchor” codec mode for the AMR-WB is the 12.65 kbps mode. It is in the same bit rate range as most today used codec types. It fits very well on the 16k Abis channel.

And – last not least – it offers the optimum on speech-quality/bit-rate relation.

The 8.85 and 6.60 modes are important for less favourable radio conditions or network conditions. They allow a smart escape in case of cell or network overload. As long as the situation allows using the higher modes this will automatically be done; only when necessary the lowest mode, 6.60 will be selected. But it makes no sense to leave the 6.60 out of the configuration, because this would force the rate control to stick to 8.85 and the frame error rate may be higher than tolerable.

The modes above 12.65 kbps are of some importance for speech in adverse background noise scenarios and also general audio signals (music) gain by the increase in bit rate. The difference between 15.85 and 23.85 is, however, not dramatic and it is not very important to have both modes in one configuration.

It can of course not be neglected that both modes require substantial more radio capacity. Especially costly is the fact that both need a 32kbps Abis/Ater link capacity, with additional problems of parallel routing and delay differences between the two 16k subchannels on Abis/Ater.

Therefore it is obvious that Configuration 0 is the most important one. It fulfils all criteria for optimal WB speech quality in all RATs with minimal resource needs.

Configurations 2 and 4 are much less important and therefore only optional.

Their application to real-time music transmission suffer from one essential lack: there exists currently no mechanism that allows a given source signal to enforce one of these higher codec modes. Instead the codec mode is mainly dominated by the rate-control mechanism, i.e. channel-controlled and not source-controlled.

A way out could be to define different service-quality-classes for call set-up: this would mean that the radio resource management must allocate a higher RF-power-target and by that increase the likelihood for the higher modes. This is relatively straightforward in UTRAN, but less obvious in GERAN and in any case: it costs radio resources.

### Why no other Configurations?

Any **single mode configuration** suffers from the facts that it is

- a) not compatible to all the other configurations (except the single mode 6.60) and
- b) not able to take advantage from the rate control and therefore runs the risk of channel overload and high frame error rates.

Any other **multi-mode configuration** is

- a) not compatible to the proposed ones, because one of the lower modes is missing (except the 6.60 / 8.85 one) and therefore the rules for maximum rate control are violated, or is
- b) containing more than 4 modes and is therefore not GERAN compatible.

**Conclusion**

The proposed three AMR-WB Configurations shall be the only allowed ones.  
Rate-Control can always restrict the higher modes to combat short term resource limitations.

The signalling for TrFO (TS 26.103) and TFO (TS 28.062) shall reflect this simplification for efficient negotiation. The TFO Decision for AMR-WB reduces to a trivial one.

The CN protocols (TS 23.153, ...) shall take these Configurations into account as well, for call set-up and handover. In-Call-Modifications from one AMR-WB configuration to another one are not essential any longer.

The terminal test specifications (TS 34.108, TS 34.123 and TS 48.010) shall reflect these Configurations as the only allowed and mandatory ones for the corresponding codec types.