

Agenda Item: 9
Source: Nokia
Title: UE controlled AMR mode adaptation (proposed CR to 25.303)
Document for: Decision

1. Introduction

This paper discusses the possibility to allow the UE to change the valid AMR mode independently upon specific circumstances on the NW. This feature is useful especially when the conditions on the air interface change so that quick AMR mode modification is required to maintain proper quality on the speech connection.

2. Information used in AMR mode decision

In GSM the AMR mode control is based on the values of the channel quality (C/I). In downlink the UE reports to the network the current value of the C/I, whilst the same value in uplink is measured by the BTS. In WCDMA the same principle cannot be used due to possible overload situations on the air interface and coverage limitations, during which required quality on the air interface cannot be maintained.

Thus for the WCDMA it is proposed that the AMR mode control should be based on cell load information. Table 1 presents a summary of differences between GSM and WCDMA.

	GSM	WCDMA
Location of AMR control	BTS	RNC
Information used in AMR control	C/I	Load
Downlink information	Mobile report C/I	BS reports total BS transmission power
Uplink information	BTS measures C/I	BS measures total interference level
Uplink information	Network control	UE may change uplink mode if max. power level is reached.

3. Uplink AMR mode adaptation

In GSM the decision to change the valid AMR mode for the speech connection is always performed on the network side and more precisely in the BTS. In WCDMA the role of the network side has so far

remained the same even as the responsible network element of the AMR mode control is changed from the BTS to the RNC.

In principle the control of the AMR mode in downlink is always handled by the RNC, according to the information, which has been received from the air interface. For the uplink two alternatives for the AMR mode control are proposed:

1. The RNC monitors the load on the air interface, and decides when to request the UE to change the valid AMR mode. After this decision a new AMR mode is sent to the UE in an AMR mode command message either as an inband message or with the aid of the TRANSPORT CHANNEL RECONFIGURATION procedure (to be decided). The UE adapts its AMR mode accordingly.
2. The UE may change the valid AMR mode of the speech connection on uplink independently, without requesting the mode change from the RNC first.

The UE doesn't have access to the load information which is used by the network to trigger AMR mode adaptation. In the UE the decision will be based on information received from the power control entity of the UE. Each time when maximum transmission power is reached the UE may independently change the AMR mode. The new mode must belong to the valid TFS specified by the NW-RRC. Thus the boundaries for selection are set by the NW. The NW detects the new AMR mode from the physical layer rate information (TFCI).

UE controlled AMR mode adaptation can be used e.g. when the coverage area of the speech connection needs to be extended. The proposed model does not decrease the usefulness of NW-originated AMR mode control, it only improves the quality of the uplink transmission on the cell boundaries and speeds up the AMR mode adaptation because no additional interaction with the NW is required.

4. Proposal

It is proposed to allow the UE to change the valid AMR mode for the speech connection independently each time the power control entity in the UE requests the AMR mode adaptation from the corresponding Codec mode management function in the UE. The new AMR mode must belong to the valid TFS, which has been given by the RRC either at the beginning of the Radio Access Bearer setup procedure or during the speech connection inside e.g. TRANSPORT CHANNEL RECONFIGURATION message.

5. References

- [1] TS 26.010, v 1.0.0 1999-04, Mandatory Speech Codec speech processing functions AMR Speech Codec; General Description; Source: 3GPP TSG-SA Codec Working Group
- [2] TS 23.110, v 3.1.0 1999-04 UMTS Access Stratum; Services and Functions; Source: Technical Specification Group Services and System Aspects
- [3] Tdoc TSGR2#2(99)601; July 1999: AMR mode adaptation in UTRAN; Source: Nokia

Text proposal for TS25.303:

5.5.1.1.13 Radio Resource Allocation tasks (DCH/DCH and DCH/DCH+DSCH)

For the DCH, several physical channel allocation strategies may be applied. The allocations can be either permanent (needing a DCH release message) or based on time or amount-of-data.

Resource allocation can be done separately for each packet burst with fast signalling on the DCH. Transition out of the Control only state is either triggered by user capacity allocation or by timeout (no data transaction requests received within a specified time period).

For each radio frame the UE and the network indicate the current data rate (in uplink and downlink respectively) using the transport format combination indicator (TFCI). If the configured set of combinations (i.e. transport format set for one transport channel) are found to be insufficient to retain the QoS requirements for a transport channel, the network initiates a reconfiguration of the transport format set (TFS) for that transport channel. This reconfiguration can be done during or in between data transmission. Further, the network can reconfigure the physical channel allowing an increase or decrease of the peak data rate.

For the uplink data transmission, the UE reports the observed traffic volume to the network in order for the network to re-evaluate the current allocation of resources. This report contains e.g. the amount of data to be transmitted or the buffer status in the UE.

If during data transfer the UE is unable to transmit at the requested output power when using the peak allocated capacity, the UE shall reduce transmission rate within the current 10 ms radio frame in order to maintain the closed-loop power control.

For codecs that support variable-rate operation the UE shall be allowed to reduce transmission rate independently without requesting a new codec mode from the NW side within the limits defined by the NW in the current TFS for the impacted radio bearer.

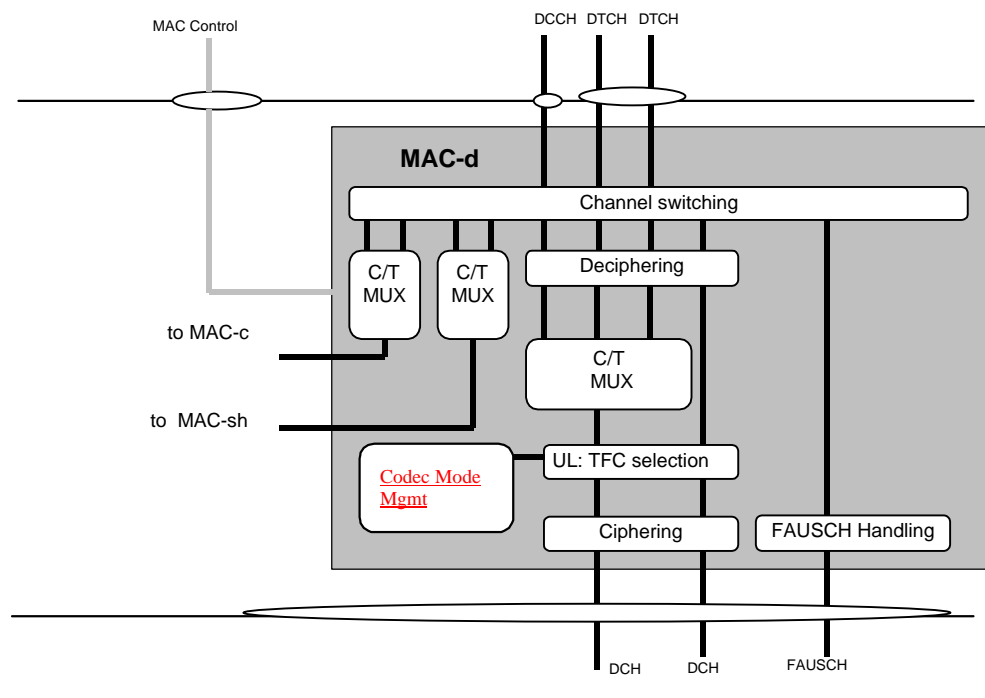
The codec mode adaptation in the UE may be initialised e.g. when the maximum power level has been reached, or it is otherwise preferable from the UE point of view to decrease the power consumption by decreasing the data rate. The new Codec mode selected by the UE is signalled to the NW by means of the TFCI.

4.2.3 Traffic Related Architecture - UE Side

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Figure 4.2.3.3 shows the UE side MAC-d entity. The following functionality is covered:

- Dynamic transport channel type switching is performed by this entity, based on decision taken by RRC.
- The C/T MUX box is used when multiplexing of several dedicated logical channels onto one transport channel is used.
- The MAC-d entity using common channels is connected to a MAC-c entity that handles the scheduling of the common channels to which the UE is assigned.
- The MAC-d entity using downlink shared channel is connected to a MAC-sh entity that handles the reception of data received on the shared channels to which the UE is assigned.
- In the uplink, transport format combination selection (out of the RRC assigned transport format combination set) is performed to prioritise transport channels.
- FAUSCH Handling indicates the function in the MAC-d supports the FAUSCH, details are ffs
- Support of Cipherring / Decipherring for transparent RLC operation in MAC , see [2] for details on the concept.
- Codec Mode Management offers such services, which allows UE to change the valid mode of the codec independently. The Codec Mode Management function works with co-operation with TFC selection function.



DL	Downlink	RNTI	Radio Network Temporary Identity
TF	Transport Format	UE	User Equipment
TFC	Transport Format Combination	UL	Uplink
Note 1 :	For DCH and DSCH different scheduling mechanism apply	Note 2 :	The TFC selection place is under discussion
		Note 3 :	Cipherring is performed in MAC-d only for transparent RLC mode

Figure 4.2.3.3. UE side MAC architecture / MAC-d details

8.3. Primitives between MAC and RRC

8.3.1. Primitives

The primitives between MAC and RRC are shown in Table 8.3.1

Generic Name	Type				Parameters
	Request	Indication	Response	Confirm	
CMAC-CONFIG	X				CHI
CMAC-CONNECT	X			X	ffs
CMAC-MEASUREMENT	X	X			TRIG. TH, RESULT, PER
CMAC-STATUS		X			Status info.
CMAC-ERROR		X			Reason for error
<u>CMAC-MODE</u>	<u>X</u>				<u>CHI, MO</u>

Table 8.3.1 Primitives between MAC sub-layer and RRC

CMAC-CONFIG Request

- CMAC-CONFIG Request is used to request for the switching the connection between logical channels and transport channels

CMAC-CONNECT Request/Confirm

- CMAC-CONNECT Request is used initiate a RRC connection
- CMAC-CONNECT Confirm is used to confirm the establishment of a RRC connection.

CMAC-MEASUREMENT Request/Indication

- CMAC-MEASUREMENT .Request is used to request to measure something radio quality at both BS and MS sides. (for example : Transport Block Error)
- CMAC-MEASUREMENT. Indication is used to notify measuring result.

CMAC-STATUS Indication

- CMAC-STATUS Indication primitive notifies the management entity of status information.

CMAC-ERROR Indication

- CMAC-ERROR Indication primitive notifies the management entity of an error detected in the operation of the MAC sub layer protocol such as excessive number of transmission attempts for Ack-mode. and timer time out.

CMAC-MODE Request

- CMAC-MODE Request is used to instruct MAC layer to send the Codec Mode Command (e.g. AMR Mode command) with information about the valid new Codec mode to the corresponding Transcoder.

8.3.2.Parameters

- a) Channel Information (CHI)
Channel information for active transport channel. For example, common channel or dedicated channel notification in user packet transmission.
- b) TH
Threshold information for measurement. For example, traffic monitor or transmission quality.
When an specific value is assigned, it means measuring should be reported with law data.
- c) PER
Period information for measurement. When an specific value is assigned, it means measuring should be reported only when measuring result exceed the given threshold.
- d) TRIG
Trigger information which request to start measuring.
- e) RESULT
Measurement result.
- f) Status info
It is management entity of status information.
- g) Reason for error
It contains the management entity of an error detected in the operation of the MAC sub layer protocol (e.g. excessive number of transmission attempts for Ack-mode).
- h) [Mode \(MO\)](#)
[Selected new Codec mode](#)

[Note(from Tdoc WG2 009/99): If used with a threshold information, the MEASURE primitive is same as an alarm indication or request for channel switching. When the condition that channel switching is needed is detected at UE side, appropriate RRC message will be sent to Network side.