Technical Specification Group Services and System Aspects *TSGS#16(02)0223*
Meeting #16, Marco Island, Florida, USA, 10-13 June 2002

Source: **TSG-SA WG4**

Title: **CRs to TS 26.103 on Default Codec Type UMTS_AMR2 (R99, Release 4 and 5)**

Document for: **Approval**

Agenda Item: **7.4.3**

The following CRs, agreed at the TSG-SA WG4 meeting #21, are presented to TSG SA #16 for approval.

Spec	CR	Rev	Phase	Subject	Cat	Vers	WG	Meeting	S4 doc
26.103	012	2	R99	UMTS_AMR2 is default Codec Type in R99 dual_mode terminals	F	3.1.0	S4	TSG-SA WG4#21	S4-020325
26.103	013	2	REL-4	UMTS_AMR2 is default Codec Type in all terminals of REL-4 and onwards	F	4.2.0	S4	TSG-SA WG4#21	S4-020326
26.103	014	2	REL-5	UMTS_AMR2 is default Codec Type in all terminals of Rel-4 and onwards	A	5.1.0	S4	TSG-SA WG4#21	S4-020327

CR-Form-v6.1

CHANGE REQUEST

| ⌘ | **TS 26.103** CR **012** | ⌘**rev** **2** ⌘ | Current version: | **3.1.0** | ⌘ |

Spec Title: Speech Codec List for GSM and UMTS ⌘

For **HELP** *on using this form, see bottom of this page or look at the pop-up text over the* ⌘ *symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network ☐ Core Network **X**

Title: ⌘	UMTS_AMR2 is default Codec Type in R99 dual_mode terminals	
Source: ⌘	TSG SA WG4	
Work item code: ⌘	TFO-AMR	*Date:* ⌘ 11-June-2002
Category: ⌘ **F**		*Release:* ⌘ R99

Use <u>one</u> of the following categories:
F (correction)
A (corresponds to a correction in an earlier release)
B (addition of feature),
C (functional modification of feature)
D (editorial modification)
Detailed explanations of the above categories can
be found in 3GPP <u>TR 21.900</u>.

Use <u>one</u> of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change: ⌘	Clarification is <u>still</u> requested	
Summary of change: ⌘	Declare UMTS_AMR2 as default Codec Type in R99 dual_mode terminals	
Consequences if not approved: ⌘	Obvious source for continuous misunderstandings	

Clauses affected: ⌘	5	
Other specs affected: ⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications	
Other comments: ⌘	The decision (UMTS_AMR2 is default Codec Type in dual-mode terminals) reaches back to Oct 2000	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.4 Adaptive Multi-Rate Codec Types

The Adaptive Multi-Rate Codec algorithm is applied in GSM and UMTS in four different Codec Types.
The Codec IDentification (CoID) codes are defined to be:
FR_AMR_CoID   := 0x0000.0011.
HR_AMR_CoID   := 0x0000.0100.
UMTS_AMR_CoID   := 0x0000.0101.
UMTS_AMR_2_CoID := 0x0000.0110.

The AMR may have several additional parameters. These parameters are optional at originating side, but mandatory for the terminating side:
Active Codec Set, ACS: eight bits.
  In FR AMR and HR AMR up to four modes may be selected by setting the corresponding bits to "1";
  In HR AMR only four out of the lower six modes can be selected;
  In UMTS AMR and UMTS AMR2 up to all eight modes may be selected.
  If the ACS is not specified at originating side, then all modes are supported there.
  The terminating side may then select freely.
  If ACS is not provided, then SCS and MACS can not be provided as well.
Supported Codec Set, SCS: eight bits.
  In FR AMR, UMTS AMR and UMTS AMR2 up to eight modes may be selected by setting the corresponding bits to "1".
  In HR AMR only the lower six modes may be selected.
  If the SCS is not specified at originating side, then all modes are supported there.
  The terminating side may then select freely.
  If SCS is not provided, then MACS can not be provided as well.

Maximal number of Codec Modes, MACS: three bits.
  In FR AMR and HR AMR one to four Codec Modes are allowed within the ACS.
  Coding: "001: one, "010": two, "011": three, "100": four Codec modes allowed.
  In UMTS AMR and UMTS AMR2 up to eight Codec Modes are allowed within the ACS.
  Coding: "001: one, "010": two, … "111": seven, "000" eight Codec modes allowed.
  If MACS is not specified at originating side, then the maximum of modes is supported there.
  The terminating side may then select freely.
Initial Codec Mode: three bits; one of the Codec Modes within the ACS is indicated as starting mode.
  Coding: "000": 4,75 kBit/s Codec Mode; … "111": 12,2 kBit/s Codec Modes is Initial Codec Mode.
  If the ICM is not specified at originating side, then the terminating side may select freely.

The Length Indicator field (LI) is set to 3, 4, 5 or 6 at originating side, depending on how many parameters are specified. The terminating side shall return the selected Codec with a full set of parameters. Hence LI shall be set to 6 always by the terminating side. If any node in the path from originating side to terminating side does not support the parameter set offered by the originating side, it may restrict it. If necessary the missing, optional parameter octets may have to be inserted then.
The "Single Codec" information element consists of 5 to 8 octets in case of the AMR Codec Types (table 5.4):

Table 5.4: Coding of "Single Codec" for the Adaptive Multi-Rate Codec Types

Octet	Parameter	MSB 8	7	6	5	4	3	2	1 LSB
1 m	Single Codec	Single Codec (see ITU-T Q.765.5)							
2 m	Length Indication	6							
3 m	Compat. Info	Compatibility Information							
4 m	OID	3GPP ("*non-ITU-T organisation according to reference [5]*', See ITU-T Q.765.5)							
5 m	CoID	FR_AMR_CoID, HR_AMR_CoID, UMTS_AMR_CoID or UMTS_AMR_2_CoID							
6 o	ACS	12.2	10.2	7.95	7.40	6.70	5.90	5.15	4.75
7 o	SCS	12.2	10.2	7.95	7.40	6.70	5.90	5.15	4.75
8 o	ICM, MACS	(spare)	(spare)	ICM			MACS		

with "m" = mandatory and "o" = optional

For information on GSM procedures (for exact details see GSM Recommendations):

The GSM AMR Codec Types comprise eight (Full Rate), respectively six (Half Rate) different Codec Modes: 12,2 … 4,75 kBit/s.

The active Codec Mode is selected from the Active Codec Set (ACS) by the network (Codec Mode Command) with assistance by the mobile station (Codec Mode Request). This Codec Mode Adaptation, also termed Rate Control, can be performed every 40 ms by going one Codec Mode up or down within the ACS. The Codec Modes in uplink and downlink at one radio leg may be different. In Tandem Free Operation both radio legs (A and B) are considered for the optimal selection of the active Codec Mode in each direction (uplink A and then downlink B, respectively vice versa) by the "Distributed Rate Control" algorithm. The worst of both radio legs determines the highest allowed Codec Mode, respectively the maximally allowed rate. Besides this "Maximum Rate Control" the active Codec Mode may sometimes be frozen to a fixed mode by any of the two radio legs to allow a smooth handover procedure ("Exact Rate Control"). All rate control commands are transmitted inband: on the radio interface, the BTS-TRAU interface and the TRAU-TRAU interface.

The Active Codec Set is configured at call setup or reconfigured during the call. It consists of one up to maximally four Codec Modes (MACS) at a given time, selected from the Supported Codec Set. The maximal number of Codec Modes and the Supported Codec Set may be constrained by the network to consider resources and radio conditions. The Active Codec Sets in uplink and downlink are identical, but may be different as well (ffs). First, at start up of Tandem Free Operation, both Active Codec Sets are taken into account to determine the common Active Codec Set. In a later phase the Supported Codec Sets and MACSs of both radio legs may be taken into account to find the optimum Common Active Codec Set. All configuration data and update protocols are transmitted inband.

The DTX scheme of the Adaptive Multi-Rate Codec Type marks with a specific SID_FIRST frame the end of a speech burst. SID_FIRST does not contain Comfort Noise parameters. This SID_FIRST starts the comfort noise generation with parameters that are calculated at receiver side from the latest received seven speech frames. A DTX hangover period needs to be applied therefore at transmitter side before sending of this SID_FIRST. Absolutely coded SID_UPDATE frames follow about every eighth frame (160 ms) in speech pauses. SID_UPDATE frames are sent independently of the cell´s TDMA frame structure and are related only to the source signal. An ONSET frame (typically) precedes in uplink direction the beginning of a new speech burst. DTX on or off is defined by the network on a cell basis. The defined Tandem Free Operation allows the reception of GSM-AMR DTX information for the downlink direction in all cases.

Note: The DTX scheme of the Enhanced Full Rate Codec Type is not compatible with the DTX scheme of the Adaptive Multi-Rate Codec Type in Codec Mode 12.2 kBit/s, although the speech modes of these two Codec Types are bit exact identical.

For information on UMTS procedures (for exact details see Release 4 specifications TS 28.062 (TFO) and TS 23.153 (TrFO).

The UMTS AMR Codec Type comprises eight different Codec Modes: 12,2 … 4,75 kBit/s.

The active Codec Mode is selected from the Active Codec Set (ACS) by the network. This Codec Mode Adaptation, also termed Rate Control, can be performed every 20 ms by going to any arbitrary Codec Mode within the ACS. The Codec Modes in uplink and downlink at one radio leg may be different. In Tandem Free Operation or Transcoder Free Operation both radio legs (A and B) are considered for the optimal selection of the active Codec Mode in each direction (uplink A and then downlink B, respectively vice versa) by a "Distributed Rate Control" algorithm. The worst of both radio legs determine the highest allowed Codec Mode, respectively the maximally allowed rate. Besides this "Maximum Rate Control" the active Codec Mode may sometimes be frozen to a fixed mode by any of the two radio legs to allow a smooth handover procedure ("Exact Rate Control"). All rate control commands are transmitted inband on the IU and A interface and out of band on the radio interface.

The Active Codec Set is configured at call setup or reconfigured during the call. It consists of one up to maximally eight Codec Modes (MACS) at a given time, selected from the Supported Codec Set. The maximal number of Codec Modes and the Supported Codec Set may be constrained by the network to consider resources and radio conditions. The Active Codec Sets in uplink and downlink are identical. At call setup the Originating Side sends the AMR parameter set (included in the Codec List). The Terminating side then selects a suitable ACS from the given information and sends it back. In case the terminating side does not support TrFO a transcoder is allocated in the path at a suitable position, preferably as close as possible to the terminating side. This transcoder may by inband signalling install a Tandem Free Operation after call setup. Then, at start up of Tandem Free Operation, both Active Codec Sets are taken into account to determine the common Active Codec Set. In a later phase the Supported Codec Sets and MACSs of both radio legs may be taken into account to find the optimum Common Active Codec Set. All configuration data and update protocols are transmitted inband on the TFO interface, but

(possibly) out of band within the UMTS network. For information on Tandem Free Operation see GSM 08.62 respectively TS 28.062.

The SCR scheme of the default Adaptive Multi-Rate Codec Type marks with a specific SID_FIRST frame the end of a speech burst. SID_FIRST does not contain Comfort Noise parameters. This SID_FIRST starts the comfort noise generation with parameters that are calculated at receiver side (!) from the latest received seven speech frames. A DTX hangover period needs to be applied therefore at transmitter side before sending of this SID_FIRST.
Absolutely coded SID_UPDATE frames follow about every eighth frame (160 ms) in speech pauses. SID_UPDATE frames are sent independently of the cell´s timing structure and are related only to the source signal.
An ONSET frame does (typically) not exist in UMTS networks, but may be received in TFO from the distant partner. It marks the beginning of a speech burst. SCR on or off is defined by the network on a cell or call (ffs) basis. The defined Tandem Free Operation and Transcoder Free Operation allows the reception of AMR SCR information for the downlink direction in all cases.

The SCR scheme of UMTS AMR Codec Type is fully compatible to the DTX scheme of FR AMR and HR AMR of GSM.

UMTS AMR2 Codec Type is similar to UMTS AMR, except for rate control. An UMTS AMR2 encoder is allowed to perform codec mode change only every 2nd frame similar to GSM AMR Codec Types. On the decoder direction, an UMTS AMR2 codec can accept mode changes in every frame. Therefore this codec type is compatible (in TFO and TrFO sense) with both UMTS AMR, FR AMR and HR AMR Codec Types.

Informative for terminals of R99 that support only UTRAN access ("UTRAN-only" terminals):
UTRAN-only terminals of R99 may either use UMTS AMR or UMTS AMR2 as default speech version in UTRAN access.

Normative for terminals that support GSM and UTRAN radio access ("**dual-mode" terminals**):
Dual-mode terminals of R99 and onwards shall use the UMTS AMR2 as the default speech version in UTRAN access. They need not support the UMTS AMR, because the UMTS AMR2 in terminals is a fully compatible replacement.

For compatibility with other systems the UMTS AMR Codec applications may optionally support various other DTX and Rate Control schemes: GSM EFR, TDMA EFR, PDC EFR.

The exact details of these Codec Types and their related procedures (DTX, Rate Control, etc) are described in the respective standard documentation.

Up to release ´99 it is not possible to establish a Transcoder Free Operation between UMTS and these other systems, but it may soon be possible to establish Tandem Free Operation between UMTS and all these other systems.

3GPP TSG-SA WG4 #21   *Tdoc S4-020326*
Rennes, France, 13-17 May 2002

	CR-Form-v6.1
CHANGE REQUEST	

⌘	**TS 26.103**	**CR**	**013**	⌘ **rev**	**2**	⌘	Current version:	**4.2.0**	⌘
	Spec Title:	**Speech Codec List for GSM and UMTS**							⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘   (U)SIM ☐   ME/UE **X**   Radio Access Network ☐   Core Network **X**

Title:	⌘	**UMTS_AMR2 is default Codec Type in <u>all</u> terminals of REL-4 and onwards**
Source:	⌘	TSG SA WG4
Work item code: ⌘	TFO-AMR	*Date:* ⌘ 11-June-2002

Category:	⌘	**F**	*Release:* ⌘ REL-4

Use <u>one</u> of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can
be found in 3GPP <u>TR 21.900</u>.

Use <u>one</u> of the following releases:
2   *(GSM Phase 2)*
R96   *(Release 1996)*
R97   *(Release 1997)*
R98   *(Release 1998)*
R99   *(Release 1999)*
REL-4   *(Release 4)*
REL-5   *(Release 5)*

Reason for change:	⌘	Clarification is <u>still</u> requested
Summary of change: ⌘	Declare UMTS_AMR2 as default Codec Type in all terminals of REL-4 and onwards. Remove FR_AMR from UTRAN access, because UMTS AMR2 is the optimal replacement for FR AMR and UMTS AMR. This has been performed in R99 already in an earlier CR.	
Consequences if not approved:	⌘	Obvious source for continuous misunderstandings

Clauses affected:	⌘	4 and 5
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	The decision (UMTS_AMR2 is default Codec Type in REL-4 terminals) reaches back to Oct 2000

first modifications in section 4

Table 4.1: Support of Codec Types in Radio Access Technologies

	TDMA EFR	UMTS AMR2	UMTS AMR	FR AMR	HR AMR	GSM EFR	GSM HR	GSM FR
GSM	not defined	not possible	Not possible	yes (4 modes)	yes (4 modes)	yes	yes	yes
UMTS	yes	yes (8 modes)	Yes (8 modes)	yes (8 modes)	yes, but use FR AMR	yes	not defined	not defined

								PDC EFR
GSM								not defined
UMTS								yes

	TDMA EFR	UMTS AMR2	UMTS AMR	(GSM) HR AMR	(GSM) FR AMR	GSM EFR	GSM HR	GSM FR
CoID	0x07	0x06	0x05	0x04	0x03	0x02	0x01	0x00
GSM	not defined	not possible	not possible	yes, 4 modi	yes, 4 modi	yes	yes	yes
UMTS	yes	yes, 8 modi	R99, UTRAN-only UEs	not defined	not defined	yes	not defined	not defined

								PDC EFR
CoID	0x0F	0x0E	0x0D	0x0C	0x0B	0x0A	0x09	0x08
GSM								not defined
UMTS								yes

CoID is reprinted here in hexadecinmal notation. It is defined in section 5.

next modifications in section 5

5.4 Four Adaptive Multi-Rate Codec Types (FR AMR, HR AMR, UMTS AMR, UMTS AMR-2)

The Adaptive Multi-Rate Codec algorithm is applied in GSM and UMTS in four different Codec Types.
The Codec IDentification (CoID) codes are defined to be:
FR_AMR_CoID   := 0x0000.0011.
HR_AMR_CoID   := 0x0000.0100.
UMTS_AMR_CoID   := 0x0000.0101.
UMTS_AMR_2_CoID := 0x0000.0110.

The AMR may have several additional parameters. These parameters are optional at originating side, but mandatory for the terminating side:
Active Codec Set, ACS: eight bits.
When applied in GSM then fFor the FR AMR and the HR AMR up to four modes may be selected by setting the corresponding bits to "1";

In HR AMR only four out of the lower six modes can be selected;
~~When applied in UMTS then f~~For the ~~FR AMR, UMTS AMR and~~ UMTS AMR-2 up to all eight modes may be selected.

If the ACS is not specified at originating side, then all modes are supported there.

If ACS is not provided, then SCS and MACS can-not be provided as well.

Supported Codec Set, SCS: eight bits.

In FR AMR~~, UMTS AMR~~ and UMTS AMR-2 up to eight modes may be selected by setting the corresponding bits to "1".

In HR AMR only the lower six modes may be selected.

If the SCS is not specified at originating side, then all modes are supported there.

If SCS is not provided, then MACS can-not be provided as well.

Maximal number of Codec Modes, MACS: three bits.

~~When applied in GSM then f~~For the FR AMR and the HR AMR one to four Codec Modes are allowed within the ACS.

Coding: "001: one, "010": two, "011": three, "100": four Codec modes allowed.

~~When applied in UMTS then f~~For the ~~FR AMR, the UMTS AMR and the~~ UMTS AMR-2 one up to eight Codec Modes are allowed within the ACS.

Coding: "001: one, "010": two, … "111": seven, "000" eight Codec modes allowed.

If MACS is not specified at originating side, then the maximum of modes is supported there.

Optimisation Mode for ACS , OM: one bit.

Coding: "0": Optimisation of the ACS not supported, "1": Optimisation of the ACS supported.

The Optimisation Mode indicates in TFO, whether the sending side supports the modification (optimisation) of its ACS for the needs of the distant side. This parameter is necessary in UMTS OoBTC to support TFO in "transcoders at the edge" scenarios. In case the OM is set to "not supported" the offered ACS can-not be altered.

Only Rate Control can then be used to restrict the modes within the ACS.

The use of the Optimisation Mode parameter for TrFO is defined in 3GPP TS 23.153 [9].

The Length Indicator field (LI) is set to 3, 4, 5 or 6 at originating side, depending on how many parameters are specified. The terminating side shall return the selected Codec with a full set of parameters. Hence LI shall be set to 6 always by the terminating side. If any node in the path from originating side to terminating side does not support the parameter set offered by the originating side, it may restrict it. If necessary the missing, optional parameter octets may have to be inserted then.

The "Single Codec" information element consists of 5 to 8 octets in case of the AMR Codec Types (table 5.4):

Table 5.4: Coding of "Single Codec" for the Adaptive Multi-Rate Codec Types

Octet	Parameter	MSB 8	7	6	5	4	3	2	1 LSB
1 m	Single Codec	Single Codec (see ITU-T Q.765.5 [6])							
2 m	Length Indication	6							
3 m	Compat. Info	Compatibility Information							
4 m	OID	ETSI OID (See ITU-T Q.765.5 [6])							
5 m	CoID	FR_AMR_CoID, HR_AMR_CoID, UMTS_AMR_CoID or UMTS_AMR_2_CoID							
6 o	ACS	12.2	10.2	7.95	7.40	6.70	5.90	5.15	4.75
7 o	SCS	12.2	10.2	7.95	7.40	6.70	5.90	5.15	4.75
8 o	OM, MACS	(spare)	(spare)	(spare)	(spare)	OM	MACS		

with "m" = mandatory and "o" = optional

For information on GSM procedures (for exact details see GSM Recommendations):

The GSM AMR Codec Types comprise eight (Full Rate), respectively six (Half Rate) different Codec Modes: 12,2 … 4,75 kBit/s.

The active Codec Mode is selected from the Active Codec Set (ACS) by the network (Codec Mode Command) with assistance by the mobile station (Codec Mode Request). This Codec Mode Adaptation, also termed Rate Control, can be performed every 40 ms by going one Codec Mode up or down within the ACS. The Codec Modes in uplink and downlink at one radio leg may be different. In Tandem Free Operation both radio legs (A and B) are considered for the optimal selection of the active Codec Mode in each direction (uplink A and then downlink B, respectively vice versa) by the "Distributed Rate Decision" algorithm. The worst of both radio legs determines the highest allowed Codec Mode,

respectively the maximally allowed rate ("Maximum Rate Control"). All rate control commands are transmitted inband: on the radio interface, the BTS-TRAU interface and the TRAU-TRAU interface.

The Active Codec Set is configured at call setup or reconfigured during the call. It consists of one up to maximally four Codec Modes (MACS) at a given time, selected from the Supported Codec Set. The maximal number of Codec Modes and the Supported Codec Set may be constrained by the network to consider resources and radio conditions.
The Active Codec Sets in uplink and downlink are ~~typically~~ identical.
First, at start up of Tandem Free Operation, ~~both~~ Active Codec Sets, the Supported Codec Sets, the MACSs and the OMs are taken into account to determine the optimal common Active Codec Set. In a later phase the Codec Lists of both radio legs may be taken into account to find the optimum configuration. For exact details see 3GPP TS 28.062. All configuration data and update protocols are transmitted inband.

The DTX scheme of the Adaptive Multi-Rate Codec Type marks with a specific SID_FIRST frame the end of a speech burst. SID_FIRST does not contain Comfort Noise parameters. This SID_FIRST starts the comfort noise generation with parameters that are calculated at receiver side (!) from the latest received seven speech frames. A DTX hangover period needs to be applied therefore at transmitter side before sending of this SID_FIRST.
Absolutely coded SID_UPDATE frames follow about every eighth frame (160 ms) in speech pauses. SID_UPDATE frames are sent independently of the cell´s TDMA frame structure and are related only to the source signal.
An ONSET frame (typically) precedes in uplink direction the beginning of a new speech burst. DTX on or off is defined by the network on a cell basis. The defined Tandem Free Operation allows the reception of GSM-AMR DTX information for the downlink direction in all cases.

Note: The DTX scheme of the Enhanced Full Rate Codec Type is not compatible with the DTX scheme of the Adaptive Multi-Rate Codec Type in Codec Mode 12.2 kBit/s, although the speech modes of these two Codec Types are bit exact identical.

Informative for terminals of R99 that support only UTRAN access ("UTRAN-only" terminals):
UTRAN-only terminals of R99 may either use UMTS AMR or UMTS AMR2 as default speech version in UTRAN access.

Normative for terminals that support GSM and UTRAN radio access ("**dual-mode" terminals**):
Dual-mode terminals of R99 and onwards shall use the UMTS AMR2 as the default speech version in UTRAN access. They need not to support the UMTS AMR, because the UMTS AMR2 in terminals is a fully compatible replacement.

Normative for all UMTS terminals of REL-4 and onwards: The UMTS AMR2 shall be the default speech version for UTRAN access in all terminals, UTRAN-only and dual-mode (GSM and UTRAN) of REL-4 and onwards.

~~**Normative for UMTS:** The FR AMR, the UMTS AMR and the UMTS AMR 2 Codec Types comprise eight different Codec Modes: 12,2 ... 4,75 kBit/s. If the UMTS AMR 2 is available then only the UMTS AMR 2 shall be indicated in the Codec List, because it is compatible to all AMR Codec Types. If the UMTS_AMR 2 is not available, then UMTS AMR shall be indicated, together with FR AMR, if FR AMR is available.~~

For information on UMTS procedures (for exact details see 3GPP TS 28.062 (TFO) and 3GPP TS 23.153 (TrFO):

The active Codec Mode is selected from the Active Codec Set (ACS) by the network. This Codec Mode Adaptation, also termed Rate Control, can be performed for the UMTS AMR every 20 ms by going to another Codec Mode within the ACS. For the UMTS AMR-2 this Codec Mode Adaptation can be performed every 20ms for the downlink traffic channel, but only every 40ms for the uplink radio channel. The UE selects at call setup one of the two possible phases for Codec Mode Adaptation (odd or even frames). During the call changes of the Codec Mode in uplink direction are only allowed in this selected phase. Rate Control commands received in downlink direction are considered at the next possible phase. By this definition the UMTS AMR-2 Codec Type is TFO and TrFO compatible to the FR AMR, HR AMR, UMTS AMR and UMTS AMR-2 Codec Types.

The Codec Modes in uplink and downlink at one radio leg may be different. In Tandem Free Operation or Transcoder Free Operation both radio legs (A and B) are considered for the optimal selection of the active Codec Mode in each direction (uplink A and then downlink B, respectively vice versa) by a "Distributed Rate Decision" algorithm. The worst of both radio legs determine the highest allowed Codec Mode, respectively the maximally allowed rate. All rate control commands are transmitted inband on the Iu and Nb interfaces and out of band on the radio interface.

The Active Codec Set is configured at call setup or reconfigured during the call. It consists of one up to maximally eight Codec Modes (MACS) at a given time, selected from the Supported Codec Set. The maximal number of Codec Modes and the Supported Codec Set may be constrained by the network to consider resources and radio conditions.
The Active Codec Sets in uplink and downlink are typically identical.
At call setup the Originating Side sends the AMR parameter set (included in the Codec List). The Terminating side then

selects a suitable ACS from the given information and sends it back. In case the terminating side does not support TrFO a transcoder is allocated in the path at a suitable position, preferably as close as possible to the terminating side. This transcoder may by inband signalling install a Tandem Free Operation after call setup. Then, at start up of Tandem Free Operation, both Active Codec Sets, the Supported Codec Sets, the MACSs and the OMs are taken into account to determine the optimal common Active Codec Set. In a later phase the Codec Lists of both radio legs may be taken into account to find the optimum configuration. All configuration data and update protocols are transmitted inband on the TFO interface, but out of band within the UMTS network. For information on Tandem Free Operation see 3GPP TS 28.062 and on Transcoder Free Operation see 3GPP TS 23.153.

The SCR scheme of the Adaptive Multi-Rate Codec Types mark with a specific SID_FIRST frame the end of a speech burst. SID_FIRST does not contain Comfort Noise parameters. This SID_FIRST starts the comfort noise generation with parameters that are calculated at receiver side (!) from the latest received seven speech frames. A DTX hangover period needs to be applied therefore at transmitter side before sending of this SID_FIRST.
Absolutely coded SID_UPDATE frames follow about every eighth frame (160 ms) in speech pauses. SID_UPDATE frames are sent independently of the cell´s timing structure and are related only to the source signal.
An ONSET frame does (typically) not exist in UMTS networks, but may be received in TFO from the distant partner. It marks the beginning of a speech burst. "SCR on" is always defined by the network. The defined Tandem Free Operation and Transcoder Free Operation allows the reception of AMR SCR information for the downlink direction in all cases.

The SCR schemes of the ~~UMTS AMR, the~~ UMTS AMR-2 ~~and the FR AMR~~ Codec Types in UMTS ~~are~~ is fully compatible to the SCR scheme of the UMTS AMR in UMTS and the DTX schemes of FR AMR and HR AMR in GSM.

3GPP TSG-SA WG4 #21
Rennes, France, 13-17 May 2002

Tdoc S4-020327

CR-Form-v6.1

CHANGE REQUEST

⌘	**TS 26.103**	**CR**	**014**	⌘**rev**	**2**	⌘	Current version:	**5.0.0**	⌘

Spec Title: Speech Codec List for GSM and UMTS ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network ☐ Core Network **X**

Title:	⌘	**UMTS_AMR2 is default Codec Type in <u>all</u> terminals of REL-4 and onwards**

Source:	⌘	TSG SA WG4

Work item code: ⌘	TFO-AMR		*Date:* ⌘	11-June-2002

Category:	⌘	**A**		*Release:* ⌘	REL-5

Use <u>one</u> of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can
be found in 3GPP <u>TR 21.900</u>.

Use <u>one</u> of the following releases:
2   *(GSM Phase 2)*
R96   *(Release 1996)*
R97   *(Release 1997)*
R98   *(Release 1998)*
R99   *(Release 1999)*
REL-4   *(Release 4)*
REL-5   *(Release 5)*

Reason for change:	⌘	Clarification is <u>still</u> requested

Summary of change: ⌘	Declare UMTS_AMR2 as default Codec Type in all terminals of REL-4 and onwards. Remove FR_AMR from UTRAN access, because UMTS AMR2 is the optimal replacement for FR AMR and UMTS AMR. This has been performed in R99 already in an earlier CR.

Consequences if not approved:	⌘	Obvious source for continuous misunderstandings

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Clauses affected:	⌘	5

Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications	

Other comments:	⌘	The decision (UMTS_AMR2 is default Codec Type in REL-4 terminals) reaches back to Oct 2000

5.4   Four Adaptive Multi-Rate Codec Types (FR AMR, HR AMR, UMTS AMR, UMTS AMR-2)

The Adaptive Multi-Rate Codec algorithm is applied in GSM and UMTS in four different Codec Types.
The Codec IDentification (CoID) codes are defined to be:
FR_AMR_CoID   := 0x0000.0011.
HR_AMR_CoID   := 0x0000.0100.
UMTS_AMR_CoID   := 0x0000.0101.
UMTS_AMR_2_CoID := 0x0000.0110.

The AMR may have several additional parameters. These parameters are optional at originating side, but mandatory for the terminating side:

Active Codec Set, ACS: eight bits.
~~When applied in GSM then f~~For the FR AMR and the HR AMR up to four modes may be selected by setting the corresponding bits to "1";
In HR AMR only four out of the lower six modes can be selected;
~~When applied in UMTS then f~~For the ~~FR AMR, UMTS AMR and~~ UMTS AMR-2 up to all eight modes may be selected.
If the ACS is not specified at originating side, then all modes are supported there.
If ACS is not provided, then SCS and MACS can-not be provided as well.

Supported Codec Set, SCS: eight bits.
In FR AMR~~, UMTS AMR~~ and UMTS AMR-2 up to eight modes may be selected by setting the corresponding bits to "1".
In HR AMR only the lower six modes may be selected.
If the SCS is not specified at originating side, then all modes are supported there.
If SCS is not provided, then MACS can-not be provided as well.

Maximal number of Codec Modes, MACS: three bits.
~~When applied in GSM then f~~For the FR AMR and the HR AMR one to four Codec Modes are allowed within the ACS.
Coding: "001: one, "010": two, "011": three, "100": four Codec modes allowed.
~~When applied in UMTS then f~~For the ~~FR AMR, the UMTS AMR and the~~ UMTS AMR-2 one up to eight Codec Modes are allowed within the ACS.
Coding: "001: one, "010": two, … "111": seven, "000" eight Codec modes allowed.
If MACS is not specified at originating side, then the maximum of modes is supported there.

Optimisation Mode for ACS , OM: one bit.
Coding: "0": Optimisation of the ACS not supported, "1": Optimisation of the ACS supported.
The Optimisation Mode indicates in TFO, whether the sending side supports the modification (optimisation) of its ACS for the needs of the distant side. This parameter is necessary in UMTS OoBTC to support TFO in "transcoders at the edge" scenarios. In case the OM is set to "not supported" the offered ACS can-not be altered.
Only Rate Control can then be used to restrict the modes within the ACS.
The use of the Optimisation Mode parameter for TrFO is defined in 3GPP TS 23.153 [9].

The Length Indicator field (LI) is set to 3, 4, 5 or 6 at originating side, depending on how many parameters are specified. The terminating side shall return the selected Codec with a full set of parameters. Hence LI shall be set to 6 always by the terminating side. If any node in the path from originating side to terminating side does not support the parameter set offered by the originating side, it may restrict it. If necessary the missing, optional parameter octets may have to be inserted then.
The "Single Codec" information element consists of 5 to 8 octets in case of the AMR Codec Types (table 5.4):

Table 5.4: Coding of "Single Codec" for the Adaptive Multi-Rate Codec Types

Octet	Parameter	MSB 8	7	6	5	4	3	2	1 LSB
1 m	Single Codec	Single Codec (see ITU-T Q.765.5 [6])							
2 m	Length Indication	6							
3 m	Compat. Info	Compatibility Information							
4 m	OID	ETSI OID (See ITU-T Q.765.5 [6])							
5 m	CoID	FR_AMR_CoID, HR_AMR_CoID, UMTS_AMR_CoID or UMTS_AMR_2_CoID							
6 o	ACS	12.2	10.2	7.95	7.40	6.70	5.90	5.15	4.75
7 o	SCS	12.2	10.2	7.95	7.40	6.70	5.90	5.15	4.75
8 o	OM, MACS	(spare)	(spare)	(spare)	(spare)	OM		MACS	

with "m" = mandatory and "o" = optional

For information on GSM procedures (for exact details see GSM Recommendations):

The GSM AMR Codec Types comprise eight (Full Rate), respectively six (Half Rate) different Codec Modes: 12,2 … 4,75 kBit/s.

The active Codec Mode is selected from the Active Codec Set (ACS) by the network (Codec Mode Command) with assistance by the mobile station (Codec Mode Request). This Codec Mode Adaptation, also termed Rate Control, can be performed every 40 ms by going one Codec Mode up or down within the ACS. The Codec Modes in uplink and downlink at one radio leg may be different. In Tandem Free Operation both radio legs (A and B) are considered for the optimal selection of the active Codec Mode in each direction (uplink A and then downlink B, respectively vice versa) by the "Distributed Rate Decision" algorithm. The worst of both radio legs determines the highest allowed Codec Mode, respectively the maximally allowed rate ("Maximum Rate Control"). All rate control commands are transmitted inband: on the radio interface, the BTS-TRAU interface and the TRAU-TRAU interface.

The Active Codec Set is configured at call setup or reconfigured during the call. It consists of one up to maximally four Codec Modes (MACS) at a given time, selected from the Supported Codec Set. The maximal number of Codec Modes and the Supported Codec Set may be constrained by the network to consider resources and radio conditions.
The Active Codec Sets in uplink and downlink are ~~typically~~ identical.
First, at start up of Tandem Free Operation, ~~both~~ Active Codec Sets, the Supported Codec Sets, the MACSs and the OMs are taken into account to determine the optimal common Active Codec Set. In a later phase the Codec Lists of both radio legs may be taken into account to find the optimum configuration. For exact details see 3GPP TS 28.062. All configuration data and update protocols are transmitted inband.

The DTX scheme of the Adaptive Multi-Rate Codec Type marks with a specific SID_FIRST frame the end of a speech burst. SID_FIRST does not contain Comfort Noise parameters. This SID_FIRST starts the comfort noise generation with parameters that are calculated at receiver side (!) from the latest received seven speech frames. A DTX hangover period needs to be applied therefore at transmitter side before sending of this SID_FIRST.
Absolutely coded SID_UPDATE frames follow about every eighth frame (160 ms) in speech pauses. SID_UPDATE frames are sent independently of the cell´s TDMA frame structure and are related only to the source signal.
An ONSET frame (typically) precedes in uplink direction the beginning of a new speech burst. DTX on or off is defined by the network on a cell basis. The defined Tandem Free Operation allows the reception of GSM-AMR DTX information for the downlink direction in all cases.

Note: The DTX scheme of the Enhanced Full Rate Codec Type is not compatible with the DTX scheme of the Adaptive Multi-Rate Codec Type in Codec Mode 12.2 kBit/s, although the speech modes of these two Codec Types are bit exact identical.

Informative for terminals of R99 that support only UTRAN access ("UTRAN-only" terminals):
UTRAN-only terminals of R99 may either use UMTS AMR or UMTS AMR2 as default speech version in UTRAN access.

Normative for terminals that support GSM and UTRAN radio access ("dual-mode" terminals):
Dual-mode terminals of R99 and onwards shall use the UMTS AMR2 as the default speech version in UTRAN access. They need not to support the UMTS AMR, because the UMTS AMR2 in terminals is a fully compatible replacement.

Normative for all UMTS terminals of REL-4 and onwards: The UMTS AMR2 shall be the default speech version in UTRAN access in all terminals, UTRAN-only and dual-mode (GSM and UTRAN) of REL-4 and onwards.

~~**Normative for UMTS:** The FR AMR, the UMTS AMR and the UMTS AMR 2 Codec Types comprise eight different Codec Modes: 12,2 … 4,75 kBit/s. If the UMTS AMR 2 is available then only the UMTS AMR 2 shall be indicated in the Codec List, because it is compatible to all AMR Codec Types. If the UMTS_AMR 2 is not available, then UMTS AMR shall be indicated, together with FR AMR, if FR AMR is available.~~

For information on UMTS procedures (for exact details see 3GPP TS 28.062 (TFO) and 3GPP TS 23.153 (TrFO):

The active Codec Mode is selected from the Active Codec Set (ACS) by the network. This Codec Mode Adaptation, also termed Rate Control, can be performed for the UMTS AMR every 20 ms by going to another Codec Mode within the ACS. For the UMTS AMR 2 this Codec Mode Adaptation can be performed every 20ms for the downlink traffic channel, but only every 40ms for the uplink radio channel. The UE selects at call setup one of the two possible phases for Codec Mode Adaptation (odd or even frames). During the call changes of the Codec Mode in uplink direction are only allowed in this selected phase. Rate Control commands received in downlink direction are considered at the next possible phase. By this definition the UMTS AMR 2 Codec Type is TFO and TrFO compatible to the FR AMR, HR AMR, UMTS AMR and UMTS AMR 2 Codec Types.

The Codec Modes in uplink and downlink at one radio leg may be different. In Tandem Free Operation or Transcoder Free Operation both radio legs (A and B) are considered for the optimal selection of the active Codec Mode in each direction (uplink A and then downlink B, respectively vice versa) by a "Distributed Rate Decision" algorithm. The worst of both radio legs determine the highest allowed Codec Mode, respectively the maximally allowed rate. All rate control commands are transmitted inband on the Iu and Nb interfaces and out of band on the radio interface.

The Active Codec Set is configured at call setup or reconfigured during the call. It consists of one up to maximally eight Codec Modes (MACS) at a given time, selected from the Supported Codec Set. The maximal number of Codec Modes and the Supported Codec Set may be constrained by the network to consider resources and radio conditions.
The Active Codec Sets in uplink and downlink are typically identical.
At call setup the Originating Side sends the AMR parameter set (included in the Codec List). The Terminating side then selects a suitable ACS from the given information and sends it back. In case the terminating side does not support TrFO a transcoder is allocated in the path at a suitable position, preferably as close as possible to the terminating side. This transcoder may by inband signalling install a Tandem Free Operation after call setup. Then, at start up of Tandem Free Operation, both Active Codec Sets, the Supported Codec Sets, the MACSs and the OMs are taken into account to determine the optimal common Active Codec Set. In a later phase the Codec Lists of both radio legs may be taken into account to find the optimum configuration. All configuration data and update protocols are transmitted inband on the TFO interface, but out of band within the UMTS network. For information on Tandem Free Operation see 3GPP TS 28.062 and on Transcoder Free Operation see 3GPP TS 23.153.

The SCR scheme of the Adaptive Multi-Rate Codec Types mark with a specific SID_FIRST frame the end of a speech burst. SID_FIRST does not contain Comfort Noise parameters. This SID_FIRST starts the comfort noise generation with parameters that are calculated at receiver side (!) from the latest received seven speech frames. A DTX hangover period needs to be applied therefore at transmitter side before sending of this SID_FIRST.
Absolutely coded SID_UPDATE frames follow about every eighth frame (160 ms) in speech pauses. SID_UPDATE frames are sent independently of the cell´s timing structure and are related only to the source signal.
An ONSET frame does (typically) not exist in UMTS networks, but may be received in TFO from the distant partner. It marks the beginning of a speech burst. "SCR on" is always defined by the network. The defined Tandem Free Operation and Transcoder Free Operation allows the reception of AMR SCR information for the downlink direction in all cases.

The SCR scheme~~s~~ of the ~~UMTS AMR, the~~ UMTS AMR-2 ~~and the FR AMR~~ Codec Type~~s~~ in UMTS ~~are~~ is fully compatible to the SCR scheme of the UMTS AMR in UMTS and the DTX schemes of FR AMR and HR AMR in GSM.