Technical Specification Group Services and System Aspects ***TSGS#18(02)0696***
Meeting #18, New Orleans, USA, 9 - 12 December 2002

Source: **TSG-SA WG4**

Title: CRs to TS 28.062 - Corrections (Release 4 and Release 5)

Document for: **Approval**

Agenda Item: **7.4.3**

The following CRs, agreed at the TSG-SA WG4 meetings #23/#24, are presented to TSG SA #18 for approval.

Spec	CR	Rev	Phase	Subject	Cat	Vers	WG	Meeting	S4 doc
28.062	035	1	Rel-4	Correction to TFO_Term state description	F	4.4.0	S4	TSG-SA WG4#23	S4-020571
28.062	036	1	Rel-5	Correction to TFO_Term state description	A	5.2.0	S4	TSG-SA WG4#23	S4-020572
28.062	037	1	Rel-5	TFO version handling	F	5.2.0	S4	TSG-SA WG4#23	S4-020573
28.062	038	1	Rel-5	Corrections to the TFO standard (wrong specification references)	F	5.2.0	S4	TSG-SA WG4#23	S4-020574
28.062	039	1	Rel-5	Correction of TFO_REQ message for AMR-WB	F	5.2.0	S4	TSG-SA WG4#24	S4-020722

3GPP TSG-SA4 Meeting #23 ***Tdoc SA4020571***
Montréal, Canada, September 30th – October 4th

CR-Form-v5

CHANGE REQUEST

⌘ **TS 28.062 CR 035** ⌘ **rev 1** ⌘ Current version: **4.4.0** ⌘

*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 ☐ Radio Access Network [X] Core Network [X]

Title:	⌘	Correction to the TFO_Term state description
Source:	⌘	TSG SA WG4
Work item code:	⌘	TFO - AMR
Date:	⌘	10 December 2002
Category:	⌘	**F**
Release:	⌘	REL-4

Use one 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 TR 21.900.

Use one 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:	⌘	The TS 28.062 has an inconsistencies between the TFO_Term description and the action tables
Summary of change:	⌘	The exit of TFO_Term to Monitor state is added.
Consequences if not approved:	⌘	The ambiguity can lead to wrong implementations: after a distant TFO disabling the local TRAU/TC would never be able to resume TFO. For example in case of a distant HO the TFO can be re-enabled but the local TC/TRAU won't answer to the TFO messages.

Clauses affected:	⌘	9.7.3
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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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.

9.7.3 TFO_Term

This State is entered when TFO is disabled by either the local or distant TRAU/TC. The TRAU/TC stops then sending TFO frames but still accepts receiving TFO frames and messages sent by the distant TRAU/TC.

When the TFO termination has been initiated locally ~~T~~the TRAU/TC transits through this state before entering to Not_Active state after the TFO termination has been acknowledged by the distant side.

When the TFO termination has been initiated by the distant TRAU/TC, the TRAU/TC enters in MONITOR state when TFO frames are no more received.

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Montréal, Canada, September 30th – October 4th

CR-Form-v5

CHANGE REQUEST

⌘ **TS 28.062** **CR** **036** ⌘ **rev** **1** ⌘ Current version: **5.2.0** ⌘

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

Title:	⌘	Correction to the TFO_Term state description
Source:	⌘	TSG SA WG4
Work item code:	⌘	TFO - AMR
Date:	⌘	10 December 2002
Category:	⌘	**A**
Release:	⌘	REL-5

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C *(functional modification of feature)*
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R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	The TS 28.062 has an inconsistencies between the TFO_Term description and the action tables
Summary of change:	⌘	The exit of TFO_Term to Monitor state is added.
Consequences if not approved:	⌘	The ambiguity can lead to wrong implementations: after a distant TFO disabling the local TRAU/TC would never be able to resume TFO. For example in case of a distant HO the TFO can be re-enabled but the local TC/TRAU won't answer to the TFO messages.

Clauses affected:	⌘	9.7.3
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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When the TFO termination has been initiated locally ~~T~~the TRAU/TC transits through this state before entering to Not_Active state after the TFO termination has been acknowledged by the distant side.

When the TFO termination has been initiated by the distant TRAU/TC, the TRAU/TC enters in MONITOR state when TFO frames are no more received.

3GPP TSG-SA4 Meeting #23 ***Tdoc SA4020573***
Montréal, Canada, September 30th – October 4th

CR-Form-v5

CHANGE REQUEST

⌘ **TS 28.062** **CR** **037** ⌘ **rev** **1** ⌘ Current version: **5.2.0** ⌘

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

Title:	⌘	TFO Version Handling
Source:	⌘	TSG SA WG4
Work item code:	⌘	TFO AMR
Date:	⌘	10 December 2002
Category:	⌘	**F**
Release:	⌘	REL-5

Use one 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)*
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Use one of the following releases:
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R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	When any CR is introduced in the TS 28.062 from REL-5, it is compulsory to explain how the different versions interwork. Furthermore an error is corrected in the section 10.2.1 where the version number had not been updated in versions 5.1 and 5.2.
Summary of change:	⌘	The version numbers that are indicated in the specification are incremented to 5.3
Consequences if not approved:	⌘	Interoperability is not possible.

Clauses affected:	⌘	4.3, 10.2.1.
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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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.

4.3 TFO Standard Version Handling

In TFO Specifications before REL-4 no TFO version handling is defined.

In TFO Specifications of REL-4 an "AMR TFO version number" is defined in the Ver (Version number) field of the AMR_ACS and AMR_SCS Extension Blocks (see clause 7) and the ATVN field in AMR Configuration frames (see Annex C). Only one REL-4 AMR TFO version is defined: version "0".

From REL-5 onwards the "TFO Version number" contained in the "TFO Version" extension block (section 7) and in "Generic Configuration Frames" (Annex H) shall reflect the Version and Subversion of the corresponding TS 28.062 (first and second digit of the TS version number, see foreword). The AMR TFO version number (Ver, AVTN, as in REL-4) shall be treated as "undefined" in case the TFO Version Number (as in REL-5 and onwards) is indicated in the TFO Messages.

The current TFO Version supports the GSM_FR, GSM_HR, GSM_EFR ,five AMR (Narrow Band) speech codec types (FR_AMR, HR_AMR, UMTS_AMR, UMTS_AMR_2, OHR_AMR: AMR-NB family) and four AMR Wide Band speech codec types (FR_AMR-WB, UMTS_AMR-WB, OFR_AMR-WB, OHR_AMR-WB: AMR-WB family).

The smallest defined TFO Version number is 0.0. It stands for all TFO Versions before 5.~~2~~3. All numbers between 0.0 and 5.~~2~~ 3 are reserved for future use. If the Local and Distant version numbers differ, the smallest version number shall have precedence and shall be applied on both sides. The following features (table 4.3-1) are optional or mandatory for the different Codec Types, depending on the applicable version number:

Table 4.3-1: TFO Version Handling

Feature→ **Codec Type↓**	**TFO Version**	**Immediate Codec Type Optimisation**	**Generic Configuration Frames**
GSM_FR GSM_HR GSM_EFR	**Optional.** The TFO Version extension block need not to be sent. If not contained in TFO Messages, or is lower than 5.~~2~~3, then Pre-REL-5 handling shall apply	**Mandatory,** if TFO Version is 5.~~2~~ 3 or higher.	If the TFO Version is lower than 5.~~2~~ 3 then Generic Configuration Frames shall not be used. Only TFO_REQ_L and (TFO_ACK_L) shall be used. If the TFO Version is 5.~~2~~ 3 or higher, then Generic Configuration Frames shall be used. TFO_REQ_L and TFO_ACK_L shall not be used embedded into TFO Frames.
FR_AMR HR_AMR UMTS_AMR UMTS_AMR2 OHR_AMR	**Optional.** The TFO Version extension block need not to be sent. If not contained in TFO Messages, or is lower than 5.~~2~~3, then Pre-REL-5 handling shall apply	**Mandatory,** if TFO Version is 5.~~2~~ 3 or higher**.**	If the TFO Version is lower than 5.~~2~~3, then Generic ConfigurationFrames shall not be used. If the TFO Version is 5.~~2~~ 3 or higher, then Generic Configuration Frames shall be used. The parameter field in REL-4 AMR Configuration frames shall be treated as undefined. TFO_REQ_L and TFO_ACK_L shall not be used embedded into TFO Frames.
FR_AMR-WB UMTS_AMR-WB OFR_AMR-WB OHR_AMR-WB	**Mandatory.** The TFO Version extension block shall always be sent.	**Mandatory.**	Generic Configuration Frames shall be used. TFO_REQ_L and TFO_ACK_L shall not be used embedded into TFO Frames.

10.2.1 Conditions for TFO_REQ, TFO_ACK, TFO_REQ_L, TFO_ACK_L, New_Local_Codec, New_Local_Config, Distant Config

In the context of TFO_REQ, TFO_ACK, TFO_REQ_L, TFO_ACK_L, New_Local_Codec, New_Local_Config, Distant_Config the following conditions are used:

A_TP (AMR_TFO_Possible)
This condition is fulfilled if an AMR NB or AMR-WB codec type is used and the TFO decision algorithms results in an immediate TFO situation. According to clause 11.2.3 these immediate TFO situations are:

- Immediate TFO with LACS == DACS
- Immediate TFO with FR – HR – Matching
- Immediate TFO with IACS == OACS
- Immediate TFO with the IACS is a subset of the OACS

NA_TP (Non_AMR_TFO_Possible)
This condition is fulfilled if a non-AMR codec type is used and the distant used codec type is equal to the local used codec type (Duc==Luc).

TM (TFO_Mismatch)

This condition is fulfilled if the TFO decision algorithm does not result in an immediate TFO situation. This is the case in the following situations:

- The local and distant side use incompatible codec types.
- Both sides use compatible AMR or compatible AMR-WB codec types and the OACS doesn't exist or the OACS isn't acceptable (Codec Mismatch Resolution has to be invoked).
- Both sides use compatible AMR or compatible AMR-WB codec types and the OACS is acceptable for TFO, but first the ACS has to be changed to the OACS.

ICO (Immediate_Codec_Type_Optimisation)

This condition is fulfilled if

- both sides indicate a TFO version greater than or equal to 5.3 and
- the available information on alternative codec types indicates that a change of the local and/or distant codec type results in a TFO configuration with a higher preference level.

The condition is re-evaluated whenever new information on alternative codec types becomes available.

3GPP TSG-SA4 Meeting #23 ***Tdoc SA4020574***
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CR-Form-v5

CHANGE REQUEST

⌘ **TS 28.062** **CR** **038** ⌘ **rev** **1** ⌘ Current version: **5.2.0** ⌘

*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 ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	Corrections to the TFO standard (wrong specification references)
Source:	⌘	TSG SA WG4
Work item code:	⌘	TFO - AMR
Date:	⌘	10 December 2002
Category:	⌘	**F**
Release:	⌘	REL-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
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Use one 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:	⌘	Some of the references for the AMR-WB codec are wrong. Furthermore there was a statement in the section 4.1 which is no more true since REL-4.
Summary of change:	⌘	The right references replaces the wrong ones.
Consequences if not approved:	⌘	The AMR-WB cannot be managed properly.

Clauses affected:	⌘	4.1, 5.2.2.3, 5.2.3a, 7.11.3.1.3
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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4 General Description

4.1 Background Information

Tandem Free Operation (TFO) is intended to avoid the traditional double speech encoding/decoding in MS to MS (GSM), MS to UE (GSM/3G) or UE to UE (3G) call configurations. In the following paragraphs the term "MS" is used for MS and UE, the term UE only if a 3G terminal is explicitly addressed.

In a normal MS-MS call configuration the Speech Signal is first encoded in the originating MS, sent over the Air Interface, converted to A-law or μ-law ITU-T Recommendation G.711 [13] in the local transcoder, carried over the fixed network, transcoded again in the distant transcoder, sent over the distant Air Interface and finally decoded in the terminating MS (see Figure 4.1-1). In this configuration, the two speech codecs (coder/decoder pairs) are in "Tandem Operation". The key inconvenience of a tandem configuration is the speech quality degradation introduced by the double transcoding. This degradation is usually more noticeable when the speech codecs are operating at low rates.

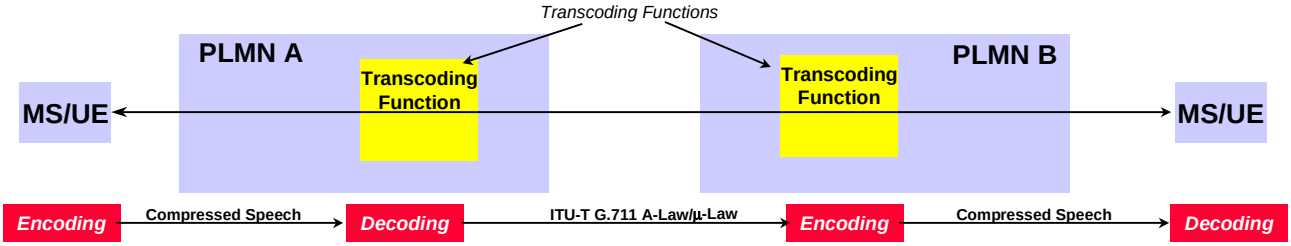

Figure 4.1-1: Typical Speech Codec Tandem Operation

When the originating and terminating connections are using the same speech codec, it is possible to transmit transparently the speech frames received from the originating MS to the terminating MS without activating the transcoding functions in the originating and terminating networks (see figure 4.1-2). In this configuration, "Tandem Free Operation" is on-going.

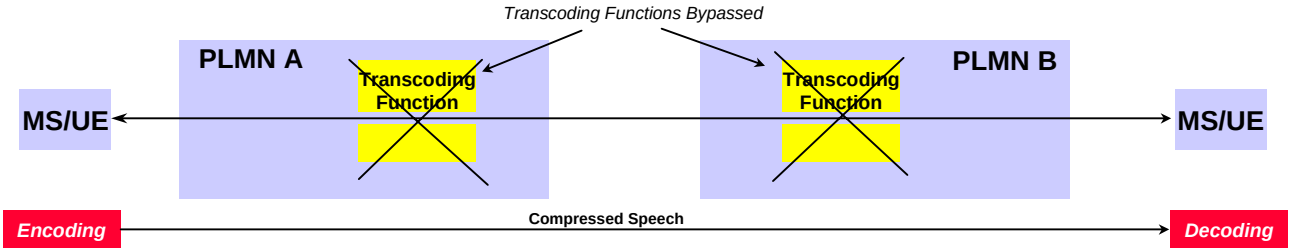

Figure 4.1-2: Tandem Free Operation of Speech Codec

The key advantages of Tandem Free Operation are:

- Improvement in speech quality by avoiding the double transcoding in the network;
- Possible savings on the inter-PLMN transmission links, which are carrying compressed speech compatible with a 32 kbit/s or 16 kbit/s or 8 kbit/s sub-multiplexing scheme, including packet switched transmission;
- Possible savings in processing power in the network equipment since the transcoding functions in the Transcoder Units are bypassed;
- Possible reduction in the end-to-end transmission delay.

The major constraint of Tandem Free Operation is that the inter-PLMN transmission links must be transparent to the compressed speech frames. This means that any device located in the transmission path (IPE: in path equipment) between the originating and the terminating transcoders must be disabled, switched-off, or made aware of the TFO situation to keep unaltered any compressed speech frame sent over the transmission path. Examples of such devices are listed in annex B.

The TFO Protocol defined in the present document provides the following services:

- Establishment of a transparent path between transcoders;
- Provision of an In-band signalling link between transcoders;
- Exchange of information on the active speech codec type and supported speech codec types at both ends of the call configuration;
- Codec Mismatch Resolution;
- Establishment and Maintenance of Tandem Free Operation when identical codec types are used at both ends of the call configuration;
- Fast and seamless fall back to Tandem Operation in case of necessary or unexpected TFO interruption (i.e. activation of supplementary services);
- Support for cost efficient transmission.

The present document defines Tandem Free Operation for the different Speech Codec Types used in GSM and GSM-evolved 3G systems. This includes the GSM_FR, GSM_HR, GSM_EFR and FR_AMR, HR_AMR, OHR_AMR, UMTS_AMR, UMTS_AMR_2, FR_AMR-WB, UMTS_AMR-WB, OFR_AMR-WB, OHR_AMR-WB codec types. However, the procedures used to establish TFO are considered system independent and could be extended to call configurations involving other systems like ISDN phones, speech servers, IP Multimedia or other wireless systems.

For non-AMR Speech Codec Types (i.e. GSM_FR, GSM_EFR and GSM_HR), Tandem Free Operation is fully compatible with the installed equipment base. The feature is fully supported by the Transcoder Units. The additional processing complexity is small compared to the encoding/decoding functions. Other network elements are not affected and possibly not aware of the establishment of Tandem Free Operation.

For the support of AMR Tandem Free Operation in GSM, the BTS and possibly the BSC may be involved in addition to the TRAU.

The resolution of a possible codec mismatch is defined as an optional feature. A codec mismatch occurs when incompatible speech codecs are used at both ends of the call configuration at call set-up. The resolution consists in finding an optimal speech codec on which TFO may be established. For that purpose, other elements in the Radio Access Network (BSS in GSM or RNC in 3G) might be involved. ~~The communication channel between the Transcoder Units and the other network elements used to transfer network parameters to solve a codec mismatch is considered a proprietary interface. It is not further defined in the present document. For GSM AMR, provision exists in the TRAU Frames to carry the network parameters across the Abis/Ater interface (see 3GPP TS 48.058, 48.060 and 48.061).~~

4.4 Document Content

In the following, clause 5 defines the structure of the TFO Frames exchanged between the Transcoder Units. The TFO Frames carry the compressed speech (payload) and some control bits for the inter-transcoder in-band signalling. Clause 6 introduces the elementary procedures used for the establishment and maintenance of Tandem Free Operation. Clause 7 defines the detailed content of the TFO messages associated with the TFO procedures. The TFO Message Structure follows the generic format defined in Annex A. Clause 8 defines how the TFO messages are mapped onto the TFO Frames. Clause 9 defines the TFO State Machine. Clause 10 contains the detailed TFO protocol. Clause 11 and 12 specify the TFO Decision algorithm and the optional Codec Mismatch Resolution.

Annex B is an informative annex defining the expected behaviour of In-Path Equipment (IPE) for compatibility with Tandem Free Operation.

Annex C and Annex D define specific TFO processes for GSM and 3G systems.

Annex E contains a reference implementation for the TFO decision algorithm (C-code) described in clause 11 and 12.

Annex F is an informative Implementer's Guide containing recommendations in the implementation and introduction of AMR TFO.

Annex G provides basic Message Flow sequences for the TFO protocol.

5.2.2.3 TFO Frame Format AMR_WB_TFO_16k and AMR_WB_TFO_32k

TFO Frames with format AMR_WB_TFO_16k and AMR_WB_TFO_32k are derived from the TRAU Frames for Adaptive Multi-Rate Wide Band as defined in the 3GPP TS 48.060. The AMR_WB_TFO_16k Frame structure is illustrated in Table 5.2.2.3-1 below, using the same notations as in 3GPP TS 48.060.

For AMR_WB_TFO_32k Frames the identical frame structure is used twice, once in the lower 16k main part (identical to the AMR_WB_TFO_16k) and in the upper 16k extension part (carrying some data bits, but no synchhronisation and no control bits, see Table 5.2.2.3-2). The unspecified bits in Table 5.2.2.3-2 shall not alter the bits of the PCM samples on the 64 kbit/s A interface.

Table 5.2.2.3-3 defines the coding of the Control Bits for the Frame Type (== Codec Type) field (C1..C4) in AMR_WB_TFO_16k and AMR_WB_TFO_32k frames. For the remaining control bits (C5…C25) the definition is as for AMR_TFO_16k frames for FR_AMR.

Table 5.2.2.3-1: Structure of AMR_WB_TFO_16k Frames and the lower 16k main part of AMR_WB_TFO_32k Frames

			Bit number					
Octet no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0a	0	0	0	0	0	0	0	0
1a	0	0	0	0	0	0	0	0
2a	1	C1	C2	C3	C4	C5	C6	C7
3a	C8	C9	C10	C11	C12	C13	C14	C15
4a	1	C16	C17	C18	C19	C20	C21	C22
5a	C23	C24	C25	D1	D2	D3	D4	D5
6a	1	D6	D7	D8	D9	D10	D11	D12
7a	D13	D14	D15	D16	D17	D18	D19	D20
8a..36a								
37a	D238	D239	D240	D241	D242	D243	D244	D245
38a	1	D246	D247	D248	D249	D250	D251	D252
39a	D253	D254	D255	D256	T1	T2	T3	T4

Table 5.2.2.3-2: Structure of the upper 16k extension part in AMR_WB_TFO_32k Frames

			Bit number					
Octet no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0b								
1b								
2b								
3b								
4b								
5b				D1	D2	D3	D4	D5
6b		D6	D7	D8	D9	D10	D11	D12
7b	D13	D14	D15	D16	D17	D18	D19	D20
8b..36b								
37b	D238	D239	D240	D241	D242	D243	D244	D245
38b	1	D246	D247	D248	D249	D250	D251	D252
39b	D253	D254	D255	D256				

Table 5.2.2.3-3: Coding of the Frame Type for AMR_WB_TFO_16k Frames and AMR_WB_TFO_32k Frames

Control Bits	Description	Comment
C1 - C4 (0.0.0.1) (0.0.1.1) (0.1.0.0) (0.1.0.1) (0.1.1.0) **1.0.0.1** **1.0.1.0** (1.0.1.1) **1.1.0.0** **0.0.1.0** (1.1.0.1)	**Frame_Type / Codec Type** (GSM_FR) (FR_AMR) (HR_AMR) (UMTS_AMR) (UMTS_AMR_2) **FR_AMR-WB** **UMTS_AMR-WB** (OHR_AMR) **OFR_AMR-WB** **OHR_AMR-WB** (GSM_EFR)	The coding is different from the coding in TFO Messages. It is also not identical to the coding on Abis/Ater. The TRAU shall translate the coding between TRAU and TFO Frames. Note: Codec Types in (brackets) are not supported by this TFO Frame format. They are listed to show their coding for convenience. Note: By definition FR_AMR-WB and OHR_AMR-WB do only use the AMR_WB_TFO_16k Frame, because they never use a Codec Mode higher than 12.65 kbit/s. UMTS_AMR-WB and OFR_AMR-WB use the AMR_WB_TFO_32k Frame when at least one Codec Mode is above 12.65 kbit/s.

NOTE: Any spare control bits shall be coded as binary "1". They are reserved for future use and may change.

The CRC covering also the control bits C1..C25 shall be recomputed in the transcoder, because some control bits change between TRAU Frames and TFO Frames, e.g. the coding of the Frame Type.

The coding of the **Data Bits** is described in 3GPP TS 48.060. In AMR_WB_TFO_32k Frames the data bits in the upper 16k extension part shall be set as defined in TS 48.060. But in all unused bit positions of this upper extension part the bits of the PCM samples shall not be altered in order to minimise the audible effect.

In 3G systems, the Frame_Classification Bits must be derived from the Frame Quality Indicator (FQI) and Frame Type Index as defined in the 3GPP TS 26.201. The conversion rules are the same as for the FR_AMR.

NOTE 1: A one-to-one relationship between Generic WB AMR Frames and TFO Frames does not always exist, but the conversion is always possible.

NOTE 2: In the generic WB AMR Frames (3GPP TS 26.~~101~~201), the differentiation between SID_FIRST and SID_UPDATE is done in the Data bits (SID Type Indicator). The Codec Mode Indication (CMI) is carried in 3G systems within the SID payload.

3G systems using the UMTS_AMR-WB Codec Type, the TC shall monitor the changes of the uplink Codec Mode, as received in the Iu Frames. Every time the Codec Mode changes in the Iu Frames the TC shall set RIF = "0" in the corresponding TFO Frame. The next TFO Frames are alternatively marked with RIF = "1", "0", "1" and so on.

NOTE 3: Per definition for UMTS_AMR-WB the UE selects the phase of potential Codec Mode changes in uplink once at call set-up and does not alter this later on. At call set-up TFO is not active and the TC has enough time to find the phase of the RIF by the proposed implicit method, before the first TFO Frame has to be sent.

The **Synchronisation Pattern** is similar to the Synchronisation Pattern in 3GPP TS 48.060, with some exceptions related to the value of the EMBED Bit:

EMBED equal "0": the Synchronisation Pattern is exactly as described in the 3GPP TS 48.060;
EMBED equal "1": the Synchronisation Pattern contains an embedded TFO Message.

For the coding of the **Data Bits** see 3GPP TS 48.060.

For the coding of the **Time Alignment Bits** (T_Bits, T1 .. T4) see 3GPP TS 48.060. When the TFO Frame is generated by a GSM Network, the T_Bits normally correspond to the T_Bits received in the up-link TRAU Frame.

5.2.3 Transmission of the bits of 16 kbit/s TFO Frames

For the purpose of this description the 320 bits of one TFO Frame are arranged in 40 rows (0..39), with 8 bit each (1..8: one octet) as in 3GPP TS 48.060.

The bits of 16 kbit/s TFO Frames are transmitted in the following order:

Bit m of octet n, shall be transmitted in the **Least** Significant Bit of the

PCM sample k = n*4 + (m+1)/2 for m = (1, 3, 5, 7) and n = (0..39).

Bit m of octet n shall be transmitted in the **second Least** Significant Bit of the

PCM sample k = n*4 + m/2 for m = (2, 4, 6, 8) and n = (0..39).

PCM sample (k=1) is the first PCM sample of the TFO Frame, which follows the received uplink TRAU frame with a small delay (Tultfo), as described in clause 8, see figure 8.1.2-1.

5.2.3a Transmission of the bits of 32 kbit/s TFO Frames

For the purpose of this description the 640 bits of one TFO Frame are arranged in 2 x 40 rows (0a..39a, 0b…39b), with 8 bit each (1..8: one octet) as in 3GPP TS 48.060, see also Table 5.2.2.3-1and Table 5.2.2.3-2.

The bits of 32 kbit/s TFO Frames are transmitted in the following order:

Bit m of octet n, shall be transmitted in the **Least** Significant Bit of the

PCM sample k = n*4 + (m+1)/2 for m = (1, 3, 5, 7) and n = (0a...39a).

Bit m of octet n shall be transmitted in the **second Least** Significant Bit of the

PCM sample k = n*4 + m/2 for m = (2, 4, 6, 8) and n = (0a..39a).

Bit m of octet n, shall be transmitted in the **third Least** Significant Bit of the

PCM sample k = n*4 + (m+1)/2 for m = (1, 3, 5, 7) and n = (0b...39b).

Bit m of octet n shall be transmitted in the **fourth Least** Significant Bit of the

PCM sample k = n*4 + m/2 for m = (2, 4, 6, 8) and n = (0b..39b).

PCM sample (k=1) is the first PCM sample of the TFO Frame, which follows the received uplink TRAU frame with a small delay (Tultfo), as described in clause 8, see figure 8.1.2-1.

It is important that the lower main 16k part and the upper 16k extension part are exactly synchronised as described above, see also clause 8.

5.2.4 Transmission of the bits of AMR_TFO_8+8k Frames

For the purpose of this description the 160+160 bits of one AMR_TFO_8+8k frame are arranged in 20 rows (1..20), with 8 bit each (1..8: one octet) as shown in Figures 5.2.2.2-1 to 5.2.2.2-4.

The bits of AMR_TFO_8+8k frames are transmitted in the following order:

Bit m of octet n of the **additional synchronisation pattern** described in Figure 5.2.2.2-4 shall be transmitted in the **Least** Significant Bit of the

PCM sample k = (n-1)*8+m; with m = (1..8) and n = (1..20).

Bit m of octet n of the **No_Speech and Speech frames** as described in Figures 5.2.2.2-1 to 5.2.2.2-3 shall be transmitted in the **Second Least** Significant Bit of the

PCM sample k = (n-1)*8+m; with m = (1..8) and n = (1..20).

PCM sample (k=1) is the first PCM sample of the TFO Frame, which follows the received uplink TRAU frame with a small delay (Tultfo), as described in clause 8, see figure 8.1.2-1.

7.11.3.1.3 AMR specific Codec_Attribute_Head Extension_Block

The AMR specific Codec_Attribute_Head Extension_Block (Table 7.11.3.1.3-1) shall precede the Codec Attribute Extension_Blocks of any AMR Codec_Type.

Table 7.11.3.1.3-1: AMR specific Codec_Attribute_Head Extension_Block

Bit	Description	Comment
Bit 1	"**0**"	normal IS-Message Sync Bit, constant.
Bit 2	**PAR_Sel**	Differentiates this Extension_Block **0:** Parameters included in **PAR** field: Simple Codec_List_Extension **1:** Length Indicator (**LI**) included: Parameters follow in subsequent Extension_Blocks
Bit 3..10	**CoID = HR_AMR or FR_AMR or UMTS_AMR or UMTS_AMR2 or OHR_AMR**	This field identifies the AMR Codec_Type for which the subsequent attributes are valid. The same coding as in the Codec_x Extension_Block is used (long form)
Bit 11	"**0**"	normal IS-Message Sync Bit, constant
Bit 12.. 15:	**LI / PAR**	If Par_Sel==1: LI: Length Indicator: 0000: reserved; 0001: one other Extension_Block follows, etc. If Par_Sel==0: PAR: Codec specific definition of these four bits
Bit 16..18:	**CRC**	3 CRC bits protecting Bits 2 to 10 and 12 to 15
Bit 19..20:	**EX**	The normal 2 bits for IS_Message Extension: 00: No other extension block follows 11: An other extension block follows

If PAR_Sel is set to "1" then the AMR_ACS and potentially AMR_SCS is/are following.
The option ”Par_Sel=0” and the corresponding configuration codes can only be used in TFO Version 5 and onwards. A Pre-REL-5 implementation does not understand it and shall ignore it.

If PAR_Sel is set to "0", then one of 15 possible AMR Configurations is indicated in the PAR field and no additional Codec Attribute Extension_Blocks do follow.
The coding for PAR (bits 12.13.14.15) is defined in Table 7.11.3.1.3-2 (Config-NB-Code):

Table 7.11.3.1.3-2: Preferred Configurations for the Adaptive Multi-Rate Codec Types

Configuration → (Config-NB-Code) ↓ Codec Mode	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
12.20								1							1	1
10.20							1						1	1		
7.95						1									1	1
7.40					1						1	1				
6.70				1						1	1	1	1	1		
5.90			1						1	1	1	1	1	1	1	1
5.15																
4.75	1								1	1	1	1	1	1	1	1
OM	**F**		**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**A**	**F**	**A**	**F**	**A**
HR_AMR	**Y**		**Y**	**Y**	**Y**	**Y**			**Y**	**Y**	**Y**					
FR_AMR, OHR_AMR, UMTS_AMR,	**Y**		**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**

UMTS_AMR_2																

The “1” in the table indicates that the Codec Mode is included in the Active Codec Set of the Configuration.

The parameter “OM” (Optimisation Mode) defines whether the indicated Configuration can be changed to any of the other Allowed ones (OM == A) or if the change is Forbidden (OM == F). For the three “A” configurations (11, 13 and 15) the TFO Decision algorithm shall consider the SCS {1, 1, 1, 1, 1, 1, 0, 1}, i.e. all AMR modes except the 5.15 kbps shall be treated as supported and the OM shall be assumed to be “Optimisation of the ACS supported”. For the other “F” configurations the ACS and SCS shall be assumed to be identical and as shown in the configuration table. The OM shall be assumed to be “Optimisation of the ACS not supported”.

A change via Maximum Rate Control is always possible (e.g. from configurations 10, 11, 12, 13, 14, 15 to 9 and 8).

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

3GPP TSG-S4 Meeting #24
Redmond, USA, 11-15 November

Tdoc ⌘S4-020722

CR-Form-v7

CHANGE REQUEST

⌘ **28.062** **CR** **039** ⌘ **rev** **1** ⌘ Current version: **5.2.0** ⌘

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

Proposed change affects: UICC apps⌘ [ ] ME [ ] Radio Access Network [X] Core Network [X]

Title:	⌘	Correction of TFO_REQ message for AMR-WB
Source:	⌘	TSG-SA WG4
Work item code:	⌘	AMRWB
Date:	⌘	10/12/2002
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one 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 TR 21.900.

Use one 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)*
Rel-6	*(Release 6)*

Reason for change:	⌘	The description of the TFO_REQ message for AMR-WB includes an ACS and SCS extension block which are no longer defined.
Summary of change:	⌘	Instead of using ACS and SCS extension blocks only use the AMR-WB specific Attribute Head Extension Block to define AMR-WB configuration.
Consequences if not approved:	⌘	TFO configuration for AMR-WB cannot be signaled in a defined way. No TFO for AMR-WB is possible.

Clauses affected:	⌘	7.11.3

	Y	N		
Other specs affected: ⌘		X	Other core specifications	⌘
		X	Test specifications	
		X	O&M Specifications	

Other comments: ⌘

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.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.

7.11.3 Codec_Type Attributes

The Codec_Types GSM Full Rate, GSM Half Rate and GSM Enhanced Full Rate do not need additional attributes. They are fully defined by the System_Identification (see Annex A.5) and the Codec_Type.

7.11.3.1 AMR Codec_Type Attributes

The Adaptive Multi-Rate Codec_Types (FR_AMR, HR_AMR, UMTS_AMR, UMTS_AMR_2, OHR_AMR) and the Adaptive Multi-Rate Wideband Codec_Types (FR_AMR-WB, ~~and~~ UMTS_AMR-WB, OFR_AMR-WB, OHR_AMR-WB) need several attributes within the TFO_REQ and TFO_ACK as well as in the TFO_REQ_L and TFO_ACK_L Messages. For Con_Req and Con_Ack frames see Annex C.

There are two major kinds of attributes: the ACS (Active Codec Set) and potentially the SCS (Supported Codec Set). These attributes are signalled differently for the AMR Codec_Types and AMR-WB Codec_Types, resulting in a different construction of TFO messages.

The ACS is related to the Local_Used_Codec_Type and is part of the Used_Codec_Attributes. One and exactly one ACS_Extension_Block shall be sent in all cases where the Local_Used_Codec_Type is an AMR Codec_Type~~FR_AMR, HR_AMR, UMTS_AMR, or UMTS_AMR_2, FR_AMR-WB or UMTS_AMR-WB within one ACS_Extension_Block~~. In all cases where the Local_Used_Codec_Type is an AMR-WB Codec_Type the ACS is signalled within the AMR-WB specific Attribute_Head Extension_Block. In the former case, the~~This~~ ACS_Extension_Block carries some more parameters, as defined in the next clause, the most important one is the "Full_Sub" flag, indicating whether or not the full set or a sub-set of the AMR codec modes~~(AMR-WB)~~ is supported. In TFO_REQ and TFO_ACK Messages the ACS shall follow immediately after the SIG_LUC_Extension_Block. In TFO_REQ_L and TFO_ACK_L Messages an Attribute_Head_Extension_Block shall follow after the Local_Codec_List, indicating the Codec_Type it specifies.~~,~~ In the case of an AMR Codec_Type ~~followed by~~ the corresponding ACS_Extension_Block is following next. In the case of an AMR-WB Codec_Type no ACS_Extension_Block is following since the ACS is already defined within the Attribute_Head.

The SCS shall be sent in TFO_REQ or TFO_ACK only if the ACS_Extension_Block indicates that the sending side does not support the full set of AMR codec modes, but a subset (Full_Sub flag). In this case the SCS_Extension_Block shall follow immediately after the ACS_Extension_Block.

NOTE 1: Hence, the TFO_Protocol can decide immediately after the reception of TFO_REQ or TFO_ACK whether TFO is possible or not, and can report the distant TFO parameters to the Control Entity in the Network.

One and only one ACS_Extension_Block is included in TFO_REQ_L and TFO_ACK_L, if the Local_Used_Codec_Type is an AMR Codec_Type.~~FR_AMR, HR_AMR, UMTS_AMR or UMTS_AMR_2, FR_AMR-WB or UMTS_AMR-WB~~. In addition, one SCS_Extension_Block is needed for each AMR Codec_Type flagged in the Local_Codec_List. In that case an Attribute_Head_Extension_Block shall follow after the Local_Codec_List, indicating the Codec_Type it specifies, followed by the corresponding SCS_Extension_Block. If multiple AMR_Codec_Types are flagged, then multiple Attribute_Heads and SCS_Extension_Blocks may be needed. If the full set of AMR Codec Modes is supported, then neither the Attribute_Head nor the SCS_Extension_Block shall be sent for the alternative Codec_Type(s). For each AMR-WB Codec_Type flaged in the Local_Codec_List, one Attribute_Head Extension_Block shall follow after the Local_Codec_List. Since the AMR-WB specific Attribute_Head fully defines the SCS no further SCS Extension_Block is following.

The following figures give the examples for the full-set AMR TFO Messages. Note that an additional TFO_Version Extension_Block shall follow if the TFO version is equal or greater than 5.

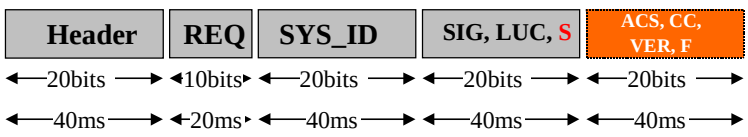

Figure 7.11.3.1-1: Construction of the shortest possible TFO_REQ Message for any AMR Codec Type

TFO_ACK follows the same construction. Both have a length of 180ms.

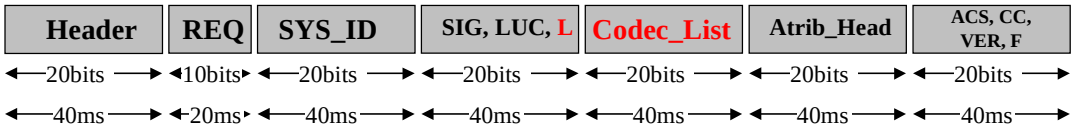

Figure 7.11.3.1-2: Construction of the shortest possible TFO_REQ_L Message listing an AMR Codec_Type in the Codec_List

TFO_ACK_L follows the same construction. Both have a length of 260ms.

NOTE 2: In TFO_REQ_L (TFO_ACK_L) at least one Attribute_Head is needed, if the Local_Used_Codec_Type is an AMR Codec_Type~~or AMR-WB~~, because otherwise a TFO partner that does not know the Local_Used_Codec_Type cannot know how many attributes are needed – if any. Since these longer messages are used only when mismatch is identified or in other situations, where protocol speed is not important, this additional 40ms message length is not important.

~~In the worst case in GSM, when both AMR Codec_Types and the FR_AMR-WB are flagged in the Codec_List, but none supports the full set, then seven Extention_Blocks need to follow after the Codec_List.~~
~~Example: FR_AMR == Local_Used_Codec_Type: Attribute_Head(FR_AMR) – ACS(FR_AMR) – SCS(FR_AMR) – Attribute_Head(HR_AMR) – SCS(HR_AMR) – Attribute_Head(FR_AMR-WB) – SCS(FR_AMR-WB)~~

For example, assume that the Local_Used_Codec_Type is FR_AMR and the supported codecs which are flagged in the Codec_List are FR_AMR, HR_AMR, and FR_AMR-WB. Then, if neither FR_AMR nor HR_AMR support the full set of AMR modes, the following six Extension_Blocks follow the Codec_List: Atrib_Head(FR_AMR) – ACS(FR_AMR) – SCS(FR_AMR) – Atrib_Head(HR_AMR) – SCS(HR_AMR) – Atrib_Head(FR_AMR-WB).