3GPP TSG CN Plenary Meeting #12 **Tdoc NP-010344**
Stockholm, Sweden, 13th - 15th June 2001

Source:	TSG-SA WG4
Title:	Liaison Reply (Re. N4-010702/S4-010337) "AMR-WB on TDM networks via TFO" (Tandem Free Operation)
Agenda item:	5.3
Document for:	INFORMATION

3GPP TSG SA4 Meeting #17 **Tdoc S4-010436**
4 - 8 June 2001, Naantali, Finland

To:	TSG-CN WG4
CC:	TSG-SA WG2, TSG-CN WG1, **TSG-CN,** TSG-GERAN

Contact Person:
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Thank you for the copy of your liaison reply to N1 on "Introduction of AMR-WB".

We noted that

> "CN4 agreed to propose a new work item (associated to the existing Wideband Telephony Service – AMR in SA4) that will be prepared and presented to the next TSG-CN WG4 (CN4 #9) meeting ..."

We herewith would like to draw your attention to the fact, that in the TFO sub-group of S4 it is studied what possible updates to 28.062 (TFO for 2G and 3G) would be needed to include AMR-WB into TFO. TFO would allow to negotiate and transport AMR-WB also in TDM networks like "classical" GSM 8bit PCM networks.
The TFO sub-group of S4 started to study this to make the – relatively straight-forward – possible extension of TFO to AMR-WB possible in the Release 5 time frame.

Some scenarios for AMR-WB in 8bit PCM TDM networks have been looked at (see Annex of this liaison). For more on this topic see the TFO sub-group report from S4#17 (S4-010435) which is attached for your convenience.

To assist you in the drafting of the work item, we provide you also with a copy of S4-010270 which lists "uncovered network aspects of the AMR-WB feature".

S4 kindly requests N1 to take the AMR-WB TFO work and the mentioned open items into account for the preparation of the new wide-band speech service work item and to keep us informed about the progress.

Thank you very much in advance for you co-operation.

Date of Next Meetings:

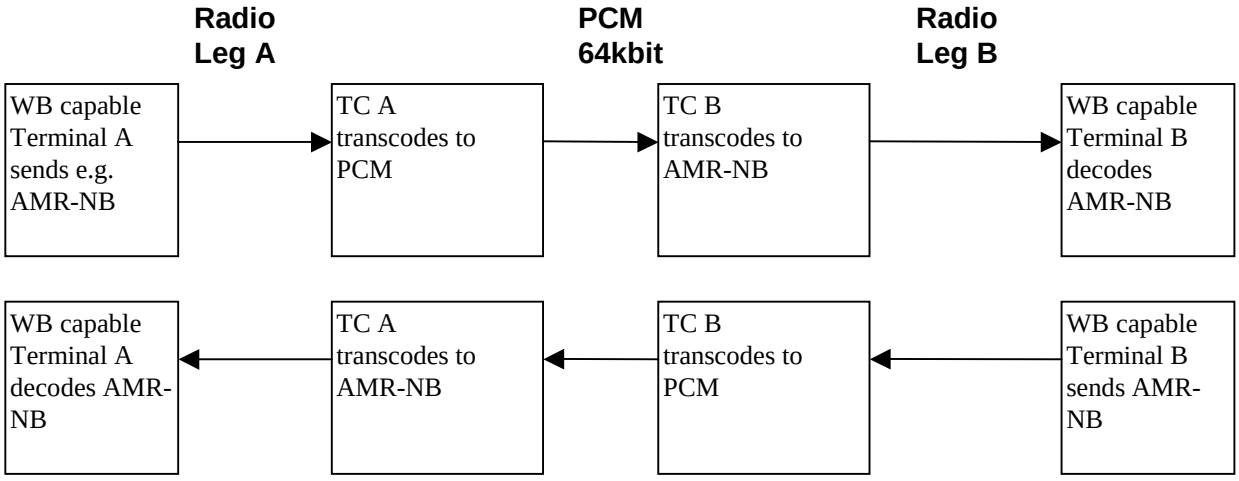
S4#18	3 – 7 September 2001,	Erlangen, Germany
TFO subgroup Ad-hoc	11 – 12 October 2001,	Munich, Germany

Attachments (2): Part of Zip-File

Annex: Scenarios for AMR-WB in TDM networks via TFO

Scenario 1: Start call with a narrowband codec type, enable TFO, change to AMR-WB in TFO

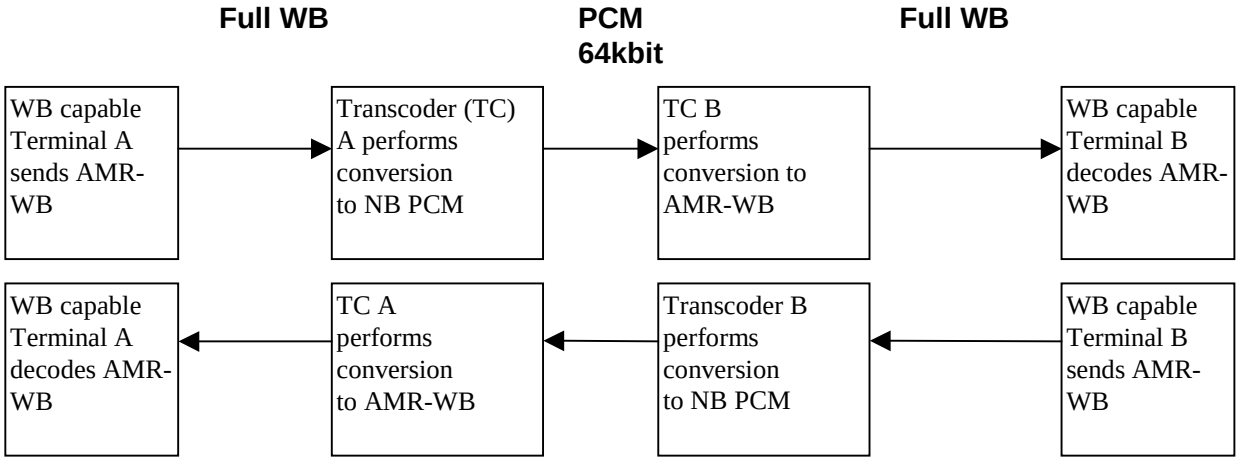
BEFORE TFO establishment:



- After call establishment with e.g. AMR-NB tandeming, the TFO protocol tries to establish TFO with AMR-WB. If that is possible, switching to AMR-WB codec is needed.
- No switching between codecs is necessary or no bandwidth or processing power is wasted for the situation that no AMR-WB capable partner is found – which is likely during the introduction phase of AMR-WB.

Scenario 2: Start call with AMR-WB on (at least one of) the radio legs, use first intermediate NB PCM, later transport AMR-WB via TFO

BEFORE TFO establishment:

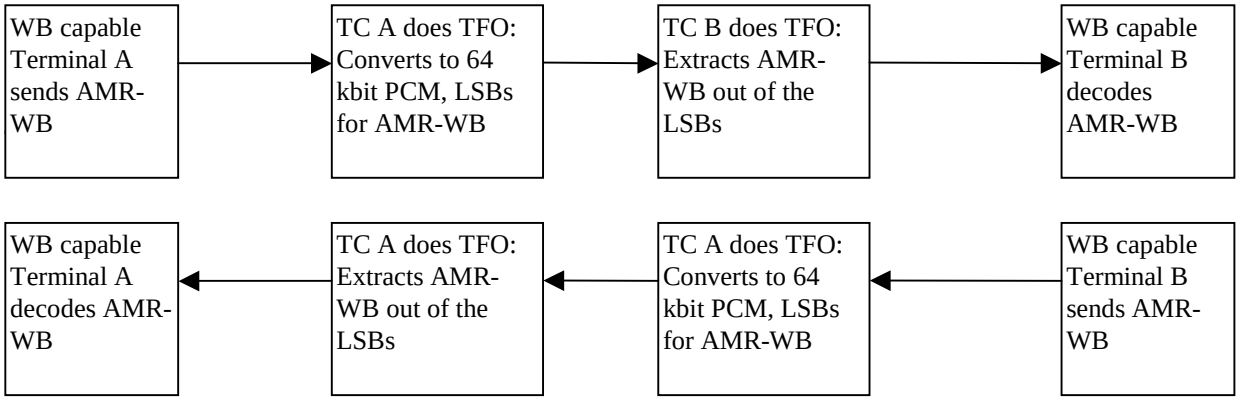


Remark: One of the terminals might start with AMR-NB e.g. because of specific set-up configuration.

- At least one radio leg uses a wideband channel, but in the beginning receives only a signal which had been converted from PCM to a 16 kHz signal with subsequent AMR-WB coding. This is accepted, because after call establishment the TFO protocol tries to establish TFO with AMR-WB. Then a real AMR-WB (TFO) call is possible.

- If no establishment of AMR-WB TFO is possible, the waste of bandwidth and capacity on the WB channel could be avoided by restricting the maximum AMR-WB mode or switching to e.g. AMR-NB.
  Remark:
  During the TFO negotiation phase the least significant bit of every 16th PCM sample is stolen for the TFO (in-band) signalling. This should have almost no audible effect.

AFTER TFO establishment (Identical for Scenario 1 and 2):



- If the establishment of TFO with AMR-WB was performed successfully, then AMR-WB is transported on the LSBs (Least Significant Bits) of the PCM signal, the MSBs (Most Significant Bits) transport a WB-to-NB converted PCM signal. This is business as usual for TFO.
- In GSM Abis full rate channel (AMR-WB Applikation A) the highest possible AMR-WB mode has 14.25 kbit/s. Results of the qualification phase of AMR-WB show that this mode gives already very good speech quality.

Remark:
TFO sub-group of S4 agreed to study both scenarios for the possible extension of TFO for AMR-WB.

Source:	**Siemens AG**[1]
Title:	**Uncovered Network Aspects of the AMR-WB Feature**
Document for:	**Discussion and Approval**
Agenda item:	**11.2**

Although the AMR-WB **codec** specifications are ready now, there are major concerns about the availability of important specifications in certain areas relating to network aspects of AMR-WB. This affects the inclusion of the AMR-WB **feature** into Release 4.

Some of the network aspects which are not covered by the current set of drafts / specifications / CRs are listed here:

1. No Architecture and no Service Requirements have been defined.

   Examples:

   - The interworking with the fixed network is not defined (e.g. if or how shall IW with fixed network broadband take place)
   - How are Tones & Announcements handled?
   - Is WB-Conferencing needed, and if yes: How is it done?
   - How about AMR-WB Voice Group Calls?
   - Are mechanisms for graceful degradation nedded when changing to NB-codecs takes place?
   - What are the impacts of AMR-WB on Accounting?
   - Which consequences on measurements has the introduction of AMR-WB?
   - How are Call Detail Records affected?
   - Must Subscriber Data in the HLR/VLR be adapted?

2. No procedures are defined to make AMR-WB available over TDM networks (e.g. no TFO or TFO-like mechanism).

3. No mechanisms for legal interception of AMR-WB have been defined

   All interception centers are currently connected via G.711. It would be very easy to hide in a broadband signal a signal which would not be detectable after conversion to narrowband. This is absolutely unacceptable for law inforcement agencies. Therefore it is likely that AMR-WB will be prohibited to be used for speech services until satisfactory interception mechanisms are defined.

It is proposed to incorporate this compilation of open issues into SA#16 plenary report and into a revision of S4-010193 (“Introduction of AMR-WB into 3GPP specifications”).

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Source:	**TSG-S4 TFO Acting Chairman**[1]
Title:	**Report of TFO Sub-group meeting during S4#17**
Agenda Item:	**9 (Tandem Free Operation = TFO)**
Document for:	**Approval**

Agenda Item 9.1 and 9.2: Opening, Agenda, Documents

The TFO Sub-group session took place from the morning of Monday, June 4, to afternoon of Wednesday, June 6. The meeting was chaired by Mr. C. Suerbaum, temporarily acting as TFO sub-group Chairman. The meeting agenda contained in **S4-010358** was approved and the documents allocated to the Agenda Items. The resulting Agenda is reported in Annex 1. The list of documents referenced, reviewed or prepared in the TFO sub-group session is provided in Annex 2. Annex 3 contains the list of 8 participants from 5 countries and 7 companies.

9.3: Incoming Reports and Liaisons

9.3.1 Review of Action Point Status

The status of the Action Points from the last meeting was reviewed and all Action Points were closed:

AP47: *Check C-Code of TFO Decision Algorithm to cover codec type UMTS_AMR_2 and related changes in clauses 11 and 12 of TS28.062 V.1.2.0 until 08:30 MET, March 7th, 2001:* ***Resp: All***
Status: Closed

AP48: *Include result of review into TS 28.062 version for approval at SA#11 and deliver it until 15:00 MET, March 9th, 2001:* ***Resp: Rapporteur***
Status: Closed (delivered and approved at SA#11 as version 4.0.0)

AP49: *Propose enhancement of "+8kbit" frame until 08:30 MET, March 7th, 2001 on the email exploder:* ***Resp: All (Nortel)***
Status: Closed (no input received)

AP50: *Include agreed changes to "+8kbit" frame format into TS 28.062 version for approval at SA#11 and deliver it until 15:00 MET, March 9th, 2001:* ***Resp: Rapporteur***
Status: Closed (see AP49)

9.3.2 Report from other Fora

TFO has been included in the Voice Enhancement Devices draft Recommendation of ITU-T SG 15 (Question 7/15: Control of signalling processing equipment and of remote transmission networks). There TFO shall be based on TFO as defined in 3GPP and 3GPP2.
Also ITU-T Question 10/11 (voice gateway equipment) studies TFO.

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TSG GERAN, May 2001, approved the CRs to 48.060 and 48.058 which were created by the TFO sub-group.

9.3.3 Incoming Liasions

S4-010313 (= N1-010943): "Introduction of AMR-WB"

It was mentioned that the main difference between "Full" AMR-WB and "Restricted" AMW-WB is not only the number of modes (all 9 versus 7 lowest), but also the different rate control schemes (AMR-WB full: receiving every 20ms, sending every 40ms; restricted AMR-WB: 40ms both directions).

If the 40ms restriction in both directions were kept also for the EDGE channel, then EDGE AMR-WB would be one more codec (again all modes, but rate change different to Full AMR-WB).

The situation is different to AMR-NB, where the two AMR versions FR_AMR and HR_AMR were defined as separate codec tpyes, because they can be transported via different radio channel types resulting in different speech quality for the same AMR-NB modes.

The discussion finally revealed: Four different code points are needed for AMR-WB: UMTS_AMR-WB, FR_AMR-WB, OFR_AMR-WB, OHR_AMR-WB (8PSK Full and Half rate channels). They are not required by TFO/TrFO protocol , but by the radio side (the terminal must be able to indicate the radio access type of which it is capable).
Remark: If 8PSK for AMR-NB will be defined, a new AMR-NB type is needed for it, too.

Together with statements about these facts, the questions raised in the liaison of N1 are answered in a liaison reply:
S4-010378: " Reply on Introduction of AMR-WB"

S4-010337 " Liaison Statement reply to CN1 on Introduction of AMR-WB" by N4, which answered the liaison by N1 (S4-010313, see above) from N4's view, reported that

> *"CN4 agreed to propose a new work item [on wideband speech service] that will be prepared and presented to the next CN4 WG (CN4 #9) meeting."*

In this regard, the TFO sub-group assessed it useful to inform N4 about the ongoing work on AMR-WB inclusion to TFO, in order to make AMR-WB available in TDM networks like "classical" GSM networks.
For this a liaison was created and can be found in
S4-010436: "AMR-WB on TDM networks via TFO"

S4-010336 (= N4-010788)**: "**Introduction of UMTS_AMR2**"**
was received by TSG CN WG 1. This liaison was noted.

As it was unclear, if TSG-T has covered the implications of UMTS_AMR2 (e.g. may be in TS 21.904 "UE capability requirements") a liaison for clarification was made:
S4-010389: "Liaison on UMTS_AMR2"

S4-010324 (= S1-010529)**: "Voice bearer interworking"**
was received by TSG SA WG 1. It implicitely requests from S4 to define a minimum set of mandatory codecs for IMS speech service.

A liasion proposing such a set was drafted and will be presented to S4 plenary for discussion:
S4-010386: "Response LS on Voice Bearer Interworking"

9.4 TFO for Release 4

It was pointed out that the deleted TFO message TFO_REQ_P is still mentioned in §10.3 of TS 28.062. In addition, UMTS_AMR_2 is not mentioned in Annex F. A CR to correct these editorial errors was drafted:
S4-010417: CR on 28.062 " Reference to deleted TFO message "

9.5 TFO for Release 5

9.5.1 Contributions

S4-010359: "Scenarios for AMR-WB in TDM networks "
was presented by Mr. Clemens Suerbaum, Siemens. This document showed two basic scenarios for AMR-WB in TDM networks:

- The first scenario is to start the call with AMR-WB on at least one radio leg, convert to narrow-band PCM in the TDM network and back to AMR-WB on the other leg of the call.
- The second scenario is to start the call with a narrow-band codec, e.g. AMR-NB.
- Then, in both scenarios, the TFO protocol tries to establish TFO with AMR-WB as common codec type. If this succeeds, AMR-WB is transported on the Least Significant Bits of the PCM signal, whereas the Most Significant Bits transport a narrowband PCM signal generated out of the AMR-WB input. This is business as usual for TFO.

The scenarios were agreed to be useful and realistic.

It was not agreed to propose an extension of RATSCCH for a fast change of codec types to TSG-GERAN. TSG-GERAN would be too "shocked" if at the very first step of AMR-WB via TFO the unpopular RATSCCH showed up. A codec change should take place via "classical" means like intra-cell handover.

It was also not agreed to restrict AMR-WB TFO to modes not higher than 14.25 bit/s. The higher modes need to steal more than 2 LSBs, thereby affecting the speech quality of the remaining PCM signal in the MSBs. But it was regarded as sufficient, that a operator of a network supporting TFO keeps this in mind. He then could choose to restrict the maximum mode for AMR-WB TFO or not, depending on his needs and priorities.

9.5.2 Work

TFO group agreed that no basic principle obstains the inclusion of AMR-WB into TS 28.062 (TFO for 2G and 3G). In the contrary, this should be rather straightforward. Therefore it was accepted to share the work towards an update of TS 28.062 for inclusion of AMR-WB, to allow possible inclusion into Release 5. For this, open items were identified and action points set up (see 9.8.2).

The following discussion results shall be respected when drafting the relevant changes to TS 28.062:

- In AMR-ACS extension block the spare bit shall be used to indicate the 9th mode of AMR-WB.
- In the AMR-SCS extension block the redundant parameter "version" shall be replaced to indicate the 9th mode in the SCS and to allow the value of 9 in the MACS.
- The maximum number of modes in the ACS is 4, like for AMR-NB
- For TFO frames TRAU frames shall be used as a base (this includes 32 kbit/s frames) – as it was already done for AMR-NB. Remark: In the 16kbit/s TRAU frame for 14.25 kbit/s mode of AMR-WB no space is left to embed TFO messages. It is therefore not possible to start TFO

when using this mode (similar situation as for highest mode in HR_AMR).

- For the TFO decision algorithm: Similar rules like the “high mode rule” and “low mode rule” for AMR-NB will be needed. But the difference to AMR-NB is: In TDM networks the alternative to AMR-WB TFO is not tandeming AMR-WB, but tandeming with a narrow-band conversion in between or even tandeming of a narrow-band codec type. Some listening samples would be helpful for an adequate definition of the decision algorithm.
- For the default codec set:
  There should be a common subset between the TFO default codec sets for restricted and full AMR-WB. This common subset should have 2 out of the lower modes for Application A, 1 of modes in the upper range of application B, and 1 of the highest modes for UMTS and EDGE channels.
  Based on S4-010374 the TFO group currently would choose as TFO default codec set the modes 8.85 and 12.65 for Application A (not 14.25, because TFO messages cannot be embedded), for Application B 18.25; for UMTS/EDGE no test results are yet available. Our guess is 23.85 .
  For the final decision the complete results of the AMR-WB characterisation are needed. The SQ subgroup was contacted and made aware of the fact that their support to choose such a default set is very welcome and needed within the Release 5 time frame. More scenarios (based on the future WI on wideband speech service) would be helpful.
  Remark: The choice of the default codec set is not so important as for AMR-NB, because immediate TFO for AMR-WB is unlikely in its introduction phase. In the related codec change handover the ACS can be chosen newly anyway (TrFO like decision for this case: all radio channels are known, and a table can be defined what to choose for the given scenario), if the call started with NB. The default codec set will gain importance, if a call will start with AMR-WB (for TrFO capable networks)
- 14 bits are left in the configuration frames and should be sufficient for additional AMR-WB related parameters. But these 14 bits are available only in no_data_frames. Consequently one speech frame has to be stolen to send the configuration.
- The decision to switch to NB (if TFO breaks and NB is detected) is not part of the TFO protocol, but part of the TRAU-BSC control.

9.6 Postponed Issues

None.

9.7 Report, outgoing Liaisons and CRs

The draft **report** (this document) was reviewed and accepted by the TFO sub-group.

Outgoing liaisons (for background information see clause 9.3.3 of this report)**:**

S4-010386: **"**Response LS on Voice Bearer Inter-Working" (Reply to incoming liaison S4-010324 = S1-010529)
To be discussed at S4 plenary

S4-010378: "Reply on Introduction of AMR-WB" (Reply to incoming liaison S4-010313 = N1-01-0943)

S4-010388: "AMR-WB on TDM networks via TFO" (Reply to incoming liaison N4-010702 = S4-010337)

S4-010389: "Liaison on UMTS_AMR2"

CR:

S4-010417: CR on 28.062 " Reference to deleted TFO message "

9.8 Any Other Business

The acting chairman thanked all participants for their fine co-operation and willingness to share the work needed to realise TFO for AMR-WB. He wishes everybody a safe and enjoyable travel home.

9.8.1 Next TFO sub-group Session

The acting TFO chairman and Rapporteur most likely will not be able to take part in the next S4#18 plenary to be held in September 2001 (Erlangen, Germany). Therefore the next TFO session will not take place during S4#18, but in an ad-hoc meeting planned for 11 - 12 of October (to be confirmed) in Munich, Germany, hosted by Siemens.

Proposed Terms of Reference for this Ad-Hoc meeting:
i) TFO in Release 4
ii) TFO in Release 5

If a CR to 48.058 is needed and should meet the next GERAN meeting, it should be discussed and agreed via email by the TFO sub-group and later be presented to SA4#18.

9.8.2 Action Points

List of action points to be completed until the next TFO session.

AP51: *Work on open items for inclusion of AMR-WB into 28.062*
First material to be distributed mid of August, if possible ***Resp: All***

AP 51.1	*Clauses 1, 2 3, 4, 6, 8 (General Descriptions and editorial changes)*	***Resp: Siemens AG***
AP 51.2	*Clause 5 (TFO frames)*	***Resp: Alcatel***
AP 51.3	*Default set (Material for Clauses 11 and 12)*	***Resp: Nortel***
AP 51.4	*Clauses 7, 9, 10, Annex C (TFO messages and protocol, configuration frames)*	***Resp: Ericsson***
AP 51.5	*Clauses 11, 12 (TFO decision algorithm)*	***Resp: Siemens AG***
AP 51.6	*Annex D (TFO in 3G)*	***Resp: Ericsson***
AP 51.7	*Annex F (Operators' Guide)*	***Resp: Nortel***
AP 51.8	*Annex G (Message flows)*	***Resp: Ericsson***

AP52: *Monitor necessity of CR to 48.058; distribute draft, if needed*

Resp: Alcatel

Annex 1: TFO Sub-Group Session - Agenda

Agenda Item			Document/s
9.1	**Opening of the meeting:** Monday, June 4, 2001		
9.2	**Approval of the agenda and registration of documents**		**S4-010358**
9.3	**Incoming Reports and Liasions**		
	9.3.1	**Report from previous meeting and Review of Action Points status**	**S4-010242**
	9.3.2	**Reports from other Fora**	
	9.3.3	**Incoming Liasions**	**S4-010313** **S4-010337** **S4-010336** **S4-010324**
9.4	**TFO Release 4: Corrections to TS 28.062 (if needed)**		**S4-010417**
9.5	**TFO Release 5: Extension of TFO to AMR-WB**		**S4-010359**
9.6	**Postponed Issues**		
9.7	**Report, outgoing Liasions and CRs**		**This document** **S4-010378** **S4-010386** **S4-010436** **S4-010389**
9.8	**Any Other Business**		

Annex 2: TFO Sub-Group Session - Document List

TFO document list for S4#16		
Document number (S4-01nnnn)	**Title**	**Source**
0242	Report of TFO sub-group meeting in SA4#16	Acting Chairman
0358	Draft Agenda of the TFO Sub-Group Session	Acting Chairman
0313	Liasion on “Introduction of AMR-WB”	3GPP TSG-CN1
0337	Liaison Statement reply to CN1 on Introduction of AMR-WB	3GPP TSG-CN4
0378	Liaison: Reply on Introduction of AMR-WB	TFO sub-group
0324	Liaison on “Voice bearer interworking”	3GPP TSG-SA1
0386	Liaison on voice bearer interworking	TFO sub-group
0336	Liaison on “UMTS_AMR_2”	3GPP TSG-CN4
0366	Liaison Statement reply to SA4 on Introduction of Codec Type UMTS_AMR_2	3GPP TSG-CN4
0389	Liaison on UMTS_AMR2	TFO sub-group
0359	Scenarios for AMR-WB on TDM networks	Siemens AG
0436	Liaison on AMR-WB on TDM networks via TFO	TFO sub-group
0374	Draft TR 26.976 AMR-WB Speech Codec Performance Characterization V0.1.0	Editor
0417	CR to 28.062: Reference to a deleted TFO message	TFO sub-group
0390	Draft report of TFO sub-group meeting during SA4#17	Acting chairman
0435	Revised report of TFO sub-group meeting during SA4#17	Acting chairman

Bold Italics: Document not presented in the meeting, but distributed earlier via the TFO exploder

Annex 3: TFO Sub-Group Session - List of Participants

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