Source:	**TSG-SA WG4 Chairman**
Title:	**TSG-SA WG4 Status Report at TSG-SA#24**
Document for:	**Information**
Agenda Item:	**7.4.1**

Executive Summary

Since TSG-SA#23, TSG-SA WG4 (SA4) has met once on 17-21 May, 2004 (SA4#31). In addition, the SA4 PSM SWG, the SA4 audio and the SA4 video codec ad-hoc groups have held one meeting each.

Release 6

Performance characterisation of default codecs for PS conversational multimedia applications: TR 26.935 "Packet switched conversational multimedia applications; Default codecs; Performance characterization" has been finalized and is brought for approval. This TR gives information of the performance of the default speech codecs (AMR and AMR-WB) in PS conversational multimedia applications under various operating and transmission conditions. Also several ITU-T speech codecs were included in the testing. The performance results can be used e.g. as guidance for network planning and to appropriately adjust the radio network parameters. The results confirm that AMR and AMR-WB operate well for packet switched conversational multimedia applications over the various tested realistic operating conditions. The finalisation of the TR completes the work under this WI.

PS Streaming (PSS) Rel-6: Two new TSs are brought for approval: TS 26.245 "Timed Text Format" and TS 26.246 "3GPP SMIL Language Profile". Also, a CR is presented to TS 26.234 "Protocols and Codecs" to bring new features into Rel-6 PSS. The CR also completes restructuring of this specification (some functionalities moved into their own Rel-6 specifications). The selection of PSS audio and video codecs has been progressed. Except for one company, SA4 has agreed ITU-T H.264 (MPEG-4 AVC) as the working assumption for recommended ("should be supported") video codec for PSS and also to several other services: MMS, PS Conversational applications and 3G-324M (CS multimedia terminal). Some technical details remain to be solved. Also, further testing has been requested by some companies. On PSS audio codecs, SA4 brings for information two sets of draft TSs for the two codec candidates (Enhanced aacPlus and Extended AMR-WB). These are intended to be recommended ("should be supported") for PSS like SA4 explained to SA#23. The formal codec selection (CR to TS 26.234 on addition of PSS audio codecs) and the codec TSs are expected for approval at SA#25.

MMS Enhancements: MMS formats and codecs: MMS audio codec selection was debated extensively at SA4#31. Most companies present in SA4 audio codec ad-hoc group session (where the detailed debate took place) stated preference for choosing one default ("shall be supported" i.e. mandatory support) MMS codec. This was seen bringing the benefit of reducing implementation costs. Some companies stated it also guaranteed interoperability, but some pointed out that interoperability to terminals of earlier releases is not guaranteed. Both candidate audio codecs (Enhanced aacPlus and Extended AMR-WB) were seen as having merits depending on the bit-rate and content type as was shown in the PSS/MMS codec selection results and analysis presented at SA#23. SA4 was not able to reach consensus on which codec of the two candidates to choose for MMS. Support was given also for other selection outcome options, e.g., for two recommended codecs, or one default encoder and two default decoders. To reach consensus, a proposal for defining two recommended codecs for MMS (similarly as for PSS) was made at the end of SA4#31 by several companies. This was put for approval by correspondence after SA4#31 since some companies requested more time to consider it. Three objections were then raised in the approval by correspondence.

Extended AMR-WB codec (AMR-WB+): The Extended AMR-WB codec developed under this work item is considered as candidate codec for PSS and MMS. The work in this WI is related to ongoing SA4 audio codec selection work for PSS and MMS as the Extended AMR-WB codec is considered as one candidate for PSS and MMS audio codec and the testing of all codec candidates has been carried out as combined testing. For the finalisation of AMR-WB+ codec specifications and presentation to SA, see the PSS and MMS audio codec work status above.

Speech Recognition and Speech Enabled Services: Codec Work to Support Speech Recognition Framework for Automated Voice Services: The verification work (for bit-exactness of the codec in specifications against the one used during testing, and verification of implementation complexity to meet design constraints) has been completed. Both codecs met the requirements. SA4 therefore asks SA approval for the SES codec selection: DSR Extended Advanced Front-end codec ("should be supported") and AMR or AMR-WB ("may be supported"). CRs to TS 26.235 and 26.236 for the definition of the SES codecs are brought for approval. The only new codec specification TS 26.243 "ANSI-C code for the Fixed-

Point Distributed Speech Recognition Extended Advanced Front-end" has been finalised and is brought for approval. As further work, a TR is planned to be produced on SES codec characterisation. This will be based on the codec test results obtained during the codec selection and verification phases. Otherwise the work is completed.

Media Codecs and Formats for IMS Messaging and Presence: There has been no input and no progress since SA4#28 (September 2003).

Definition of MBMS user services, media codecs, formats and transport/application protocols using Multimedia Broadcast/Multicast Service (MBMS): Application level Forward Error Correction (FEC) and proposed candidate solutions have been debated further. A document on simulation guidelines is being finalised with relevant RAN and GERAN WGs to be used to compare the FEC proposals. It is expected that at the next meeting SA4 will evaluate the competing FEC schemes with a target to make selection. To achieve reliable transmission, SA4 agreed that point-to-point (ptp) repair is needed in addition to FEC. Point-to-multipoint (ptm) repair is for further study. Besides issues on reliable transfer, protocol definitions have been progressed. Clarifications have been made on the use of download delivery methods (e.g. requirements for support for the different features in FLUTE) and on the use of SDP. SA3 has proposed a joint meeting with SA4 on MBMS security issues and SA4 has planned an ad-hoc meeting on MBMS on 23rd August (to be confirmed) and has invited SA3 delegates to participate.

Codec Enhancements for Packet Switched Conversational Multimedia Applications: Except for one company, SA4 has agreed on working assumption to adopt H.264 (AVC) as recommended video codec for PS conversational multimedia applications. Draft specification text to adopt H.264 (AVC) into TS 26.235 has been prepared.

3G-324M Improvements: Addition of optional H.264 (AVC) and AMR-WB support has been discussed. Draft CR text to TS 26.111 was formulated on optional H.264 (AVC) and AMR-WB, but no agreements were yet taken and the draft CR was provided for information. Delegates were invited to comment until next SA4 meeting.

Maintenance of releases:

CR is presented to TS 26.236 (Rel-5, Rel-6) on "RTCP usage for IMS". (Note: In addition, several Rel-6 WI output CRs are brought for approval as explained above; to TSs 26.234, 26.235 and 26.236.)

TSG-SA WG4 Status Report at TSG-SA#24 - Table of Contents

1. General issues

This document presents the status report of TSG-SA WG4 (SA4) at TSG-SA#24. Slides presentation of the report is given in Tdoc SP-040409.

1.1 Officials

The SA4 officials are:

Chairman: Kari Järvinen (Nokia, ETSI)

Vice Chairpersons: Catherine Quinquis (Orange, ETSI) and Frédéric Gabin (NEC Technologies, ETSI)

Secretary: Paolo Usai (3GPP Support)

SWG Chairmen:

    PSM (Packet Switched Multimedia) (open)
    SQ (Speech Quality)   Paolo Usai (ETSI)

Ad-hoc group chairmen:

    Audio Codec Ad-Hoc   Imre Varga (Siemens, ETSI)
    Video Codec Ad-Hoc   Nikolaus Färber (Fraunhofer Gesellschaft, ETSI)

Kari Järvinen (Nokia, ETSI) was re-elected as SA4 Chairman at the last SA4 meeting (SA4#31 in May) for another two-year term by acclamation.

The PSM SWG Chairman stepped down after SA4#31. Thanks to Rolf Hakenberg (Panasonic, ETSI) on behalf of SA4 for the excellent work as PSM SWG Chairman!

1.2 Meetings

Since TSG-SA#23, SA4 has held one plenary meeting SA4#31 (in May). In addition, a meeting of the PSM SWG and the video codec ad-hoc group were held in April.

Two SA4 meetings have been scheduled for the rest of 2004. A meeting of the audio codec ad-hoc group has also been scheduled (still before SA4#24). SA3 has proposed a joint meeting with SA4 on MBMS security issues. SA4 has therefore planned an ad-hoc meeting on MBMS security related issues to take place on 23rd August (to be confirmed) and has invited SA3 delegates to participate.

Meetings held before SA#24:

PSM SWG ad-hoc #5	5-6 April, 2004	Host: Ericsson; Venue: Lund, Sweden
Video codec ad-hoc #2	7 April, 2004	Host: Ericsson; Venue: Lund, Sweden
SA4#31	17 - 21 May, 2004	Host: VoiceAge; Venue: Montreal, Canada
SA4 audio codec ad-hoc[1]	4 June, 2004	Host: Coding Technogies; Venue: Nuremberg, Germany

Calendar of future meetings:

SA4#32	16 - 20 August, 2004	Host: The European Friends of 3GPP; Venue: Prague, The Czech Republic
SA4 ad-hoc meeting on MBMS with SA3 delegates invited	23 August (to be confirmed)	Host: tbd; Venue: tbd
SA4#33	22 - 26 November, 2004	Host: The European Friends of 3GPP; Venue: Helsinki, Finland

During SA4#31, all SA4 SWGs and ad-hoc groups met. Table 1 gives overall statistics from the meeting (including also statistics from some previous SA4 meetings for comparison).

Meeting	Number of (new) input documents	Number of participants	Number of incoming LSs	Number of outgoing LSs/communications
SA4#25	115	55	13	9
SA4#25bis	164	50	14	11
SA4#26	171	55	18	17
SA4#27	142	65	19	14
SA4#28	128	55	18	9

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[1] The audio codec ad-hoc meeting was authorised by SA4#31 to approve, on behalf of SA4, the audio codec verification work and the new audio codec TSs.

SA4#29	167	53	18	8
SA4#30	215	74	27	9
SA4#31	**168**	**57**	**26**	**7**

Table 1: Statistics from SA4#31 (and from some past SA4 meetings for comparison)

1.3 Input documents from SA4 to TSG-SA#24

Table 2 gives a complete list of input documents from SA4 to TSG-SA#24.

Most of the documents bring the output of SA4 Rel-6 work to SA for approval or for information. Three new TSs and one new TR are brought for approval. Nine draft TSs are presented for information. In addition, there are several Rel-6 CRs. The new TR is on performance characterization of PS conversational default codecs. One of the TSs is on SES codecs containing the ANSI-C code for the Fixed-Point Distributed Speech Recognition Extended Advanced Front-end. Corresponding CRs are brought to TSs 26.235 and 26.236 introducing the SES codecs for PS conversational applications. The other new TSs are on Timed Text Format and on SMIL Language Profile. Also, a CR is presented to TS 26.234 (PSS: Protocols and codecs) bringing several new Rel-6 features into PSS. This CR also completes the restructuring of this specification (some functionalities moved into their own Rel-6 specifications). The nine TSs presented for information are all on new audio codecs. In addition, one maintenance CR to TS 26.236 (Rel-5 and Rel-6) on "RTCP usage for IMS" is presented for approval.

Tdoc	Title	Source	Agenda Item	Document for
SP-040341	TSG S4 Status Report at TSG-SA#24	SA WG4 Chairman	7.4.1	Information
SP-040342	3GPP TR 26.935: "Packet Switched Conversational Multimedia Applications; Performance Characterisation of Default Codecs" Version 2.0.0 (Release 6)	SA WG4	7.4.3	Approval
SP-040343	3GPP TS 26.243: "ANSI-C code for the Fixed-Point Distributed Speech Recognition Extended Advanced Front-end" Version 2.0.0 (Release 6)	SA WG4	7.4.3	Approval
SP-040344	3GPP TS 26.245: "Transparent end-to-end packet switched streaming service (PSS); Timed text format" Version 2.0.0 (Release 6)	SA WG4	7.4.3	Approval
SP-040345	3GPP TS 26.246: "Transparent end-to-end packet switched streaming service (PSS); 3GPP SMIL Language Profile" Version 2.0.0 (Release 6)	SA WG4	7.4.3	Approval
SP-040356	CRs TS 26.235 and TS 26.236 on the introduction of the DSR codec (Release 6)	SA WG4	7.4.3	Approval
SP-040357	CRs TS 26.236 on "RTCP usage for IMS" (Release 5 and Release 6)	SA WG4	7.4.3	Approval
SP-040409	Slides for the TSG S4 Status Report presentation at TSG-SA#24	SA WG4 Chairman	7.4.1	Information
SP-040425	3GPP TS 26.273: "Fixed-point ANSI-C code for the Extended Adaptive Multi-Rate - Wideband (AMR-WB+) codec" Version 1.0.0 (Release 6)	SA WG4	7.4.3	Information
SP-040426	3GPP TS 26.290: "Audio codec processing functions; Extended Adaptive Multi-Rate - Wideband (AMR-WB+) codec; Transcoding functions" Version 1.0.0 (Release 6)	SA WG4	7.4.3	Information
SP-040427	3GPP TS 26.304: "Floating-point ANSI-C code for the Extended Adaptive Multi-Rate - Wideband (AMR-WB+) codec" Version 1.0.0 (Release 6)	SA WG4	7.4.3	Information
SP-040428	3GPP TS 26.401: "General audio codec audio processing functions; Enhanced aacPlus general audio codec; General description" Version 1.0.0 (Release 6)	SA WG4	7.4.3	Information
SP-040429	3GPP TS 26.402: "General audio codec audio processing functions; Enhanced aacPlus general audio codec; Additional decoder tools" Version 1.0.0 (Release 6)	SA WG4	7.4.3	Information
SP-040430	3GPP TS 26.403: "General audio codec audio processing functions; Enhanced aacPlus general audio codec; Encoder specification; Advanced Audio Coding (AAC) part" Version 1.0.0 (Release 6)	SA WG4	7.4.3	Information
SP-040431	3GPP TS 26.404: "General audio codec audio processing functions; Enhanced aacPlus general audio codec; Encoder specification; Spectral Band Replication (SBR)	SA WG4	7.4.3	Information

	part" Version 1.0.0 (Release 6)			
SP-040432	3GPP TS 26.405: "General audio codec audio processing functions; Enhanced aacPlus general audio codec; Encoder specification; Parametric stereo part" Version 1.0.0 (Release 6)	SA WG4	7.4.3	Information
SP-040433	3GPP TS 26.410: "General audio codec audio processing functions; Enhanced aacPlus general audio codec; ANSI-C code" Version 1.0.0 (Release 6)	SA WG4	7.4.3	Information
SP-040434	CRs TS 26.234 on Addition of Release 6 functionality	SA WG4	7.4.3	Approval

Table 2: List of input documents from SA4 to TSG-SA#24

2. Release 6 Work Items

2.1 Performance Characterisation of Default Codecs for PS Conversational Multimedia Applications

TR 26.935 "Packet switched conversational multimedia applications; Default codecs; Performance characterization" has been finalized and is brought for approval in Tdoc SP-040342. This TR contains the result of characterisation tests. It gives information of the performance of the default speech codecs (AMR and AMR-WB) in PS conversational multimedia applications under various operating and transmission conditions. The preparation of the TR completes the work under this WI.

A draft version 1.0.0 of the TR was presented for information at SA#23. A number of updates have been made since then including the following: several figures corrected, list of references and abbreviations completed, the four referred SA4 documents included as annexes into the TR, editorial improvements done for the text throughout the TR, Annex A corrected (tables of scores), and conclusions-section redrafted/finalised.

2.1.1 Characterisation testing

The characterisation testing was carried out from October 2003 until February 2004. The results were reported and the testing work approved at SA#22 (for Phase 1) and at SA#23 (for Phase 2). The testing and analysis of results was funded by 160 kEuro allocated by 3GPP PCG and the contingency of 34 kEuro left from the earlier AMR-WB Characterisation Phase.

The characterisation testing was divided into 2 phases. Phase 1 considered the default speech codecs AMR and AMR-WB in various operating conditions. Phase 2 considered also several ITU-T codecs.

- Phase 1 tests consisted of 24 test conditions both for the AMR codec (modes 6.7 and 12.2 kbit/s) and the AMR-WB codec (modes 12.65 and 15.85 kbit/s) with error conditions covering both IP packet loss of 0% and 3% and radio conditions with 10^{-2}, 10^{-3} and $5 \cdot 10^{-4}$ BLER (Block Error Rate). End-to-end delays of 300 and 500 ms were covered. Robust Header Compression (ROHC), an optional UMTS functionality, was included for some test cases for AMR-WB. Three types of background noise were used: car, street and cafeteria. France Telecom R&D acted as host laboratory. The subjective testing laboratories were ARCON for the North American English language, France Telecom R&D for the French language and NTT-AT for the Japanese language.

- In Phase 2, the following codecs were tested: AMR (modes 6.7 and 12.2 kbit/s), AMR-WB (modes 12.65 and 15.85 kbit/s), ITU-T G.723.1 (mode 6.4 kbit/s), ITU-T G.729 (mode 8 kbit/s), ITU-T G.722 (mode 64 kbit/s) and ITU-T G.711 (64 kbit/s). Transmission error conditions covered IP packet loss of 0% and 3%. France Telecom R&D acted as host and listening laboratory. Two languages were used (French and Arabic).

Siemens provided the real time air interface simulator for Phase 1. France Telecom provided the IP core network simulator and terminal simulator used in both Phases. (IPv6 was employed in the testing.) The example VoIP communication simulated complies with 3GPP specifications and presents a (potentially) realistic scenario. Dynastat performed the global analysis for both phases.

2.1.2 Results

The results confirm that the default speech codecs (AMR and AMR-WB) operate well for packet switched conversational multimedia applications over various realistic operating conditions (i.e., packet loss, delay, background noise, radio conditions and ROHC).

The quality is somewhat reduced when packet losses occur and the end-to-end delay is increased, but the overall quality still remains acceptable even with 3% packet loss rate in the terrestrial IP network and up to a maximum of 1% BLER on each radio leg. The results also indicate that users have clear preference for AMR-WB speech over AMR speech.

The performance results can be used as guidance for network planning regarding the QoS parameters for VoIP.

Table 3 lists the output specification for this WI (one TR). This TR is now completed and presented for approval.

Deliverable	Title	Prime resp. WG	2nd resp. WG	Comment/Status	TSG-SA approval target
TR 26.935	Performance characterization of default codecs for PS conversational multimedia applications	SA4	-	Version 1.0.0 presented for information at SA#23. Version 2.0.0 presented for approval at SA#24.	SA#24 (June 2004)

Table 3: Status list of output TSs/TRs/CRs for Performance characterisation of default codecs for PS conversational multimedia applications

2.2 Packet Switched Streaming Rel-6

2.2.1 New specifications and features

Two new TSs are brought for approval: TS 26.245 "Transparent end-to-end packet switched streaming service (PSS); Timed text format" in Tdoc SP-040344 and TS 26.246 "Transparent end-to-end packet switched streaming service (PSS); 3GPP SMIL Language Profile" in Tdoc SP-040345. (Version 1.0.0 of TS 26.246 was presented for information at SA#22.) Timed text format and SMIL Language Profile were contained in TS 26.234 in Rel-5. For Rel-6, own TSs have beed devoted for both entities for additional clarity and for easy referencing.

TS 26.245 defines the timed text format relative to the 3GPP file format. Timed text is text that is rendered at the terminal, in synchronization with other timed media such as video or audio. Timed text is used for such applications as closed captioning, titling, and other visual annotation of timed media. The format of timed text is defined for downloaded files. Timed text is downloaded like in Rel-5, not streamed. Downloading is practical as robustness for errors is vital for text. Timed text format for Rel-6 contains optional text wrap and some minor updates from Rel-5.

TS 26.246 contains the specification of the 3GPP SMIL (Synchronized Multimedia Integrated Language) Language Profile. SMIL is used for the description of the spatial layout and temporal behaviour of a presentation. The 3GPP SMIL Language Profile is a markup language based on SMIL 2.0 Basic and SMIL Scalability Framework (from W3C). It is a subset of SMIL 2.0 Full profile and a superset of SMIL 2.0 Basic. The 3GPP SMIL Language Profile is used by the PSS and MMS services, but is not restricted to be used with only these services. Compared to SMIL in Rel-5, the set of high-level features remains unchanged. The main additions for Rel-6 are in details as listed below:
- media Parameters module from SMIL 2.0 and specification how to use it
- more details on how to use systemCaption attribute of SMIL 2.0 BasicContentControl module
- new URIs to check for 3GPP Rel-6 document conformance and SMIL player conformance

TS 26.234 "Transparent end-to-end packet switched streaming service (PSS); Protocols and Codecs" (existing in Rel-5) will be updated for Rel-6 through CRs. A CR on "addition of Release 6 functionality" is brought for approval in Tdoc SP-040434. The CR brings several Rel-6 updates and also completes restructuring of this specification (some functionalities moved into their own Rel-6 specifications). One of the main improvements of PSS in Rel-6 (included in the CR) is that a server can adapt to actual transmission conditions via feedback from client buffer states. On the client side, this means that playout interruptions and overfillinging of buffers can be avoided or minimized. It also gives the potential for advanced features such as bitstream switching depending on transport conditions.

The new PSS features in the CR to TS 26.234 include:
- support for media stream selection by clients (alternatives in SDP); e.g., to allow sessions with several bit-rates or languages to be offered by the server
- support for bitrate adaptation; buffer feedback from client is used by the server to achieve enhanced robustness for varying transmisson rates and enables bit-rate switching.
- extended support for synthetic audio; SP-MIDI has been complemented with Mobile Downloadable Sounds
- support for Quality of Experience (QoE) metrics; for servers to receive information from the handset to provide the service providers means to evaluate the end user experience
- clarifications, updates and extensions to a number of protocols (SDP, RTSP, RTP, RTCP); e.g.,
    - signalling for media stream selection
    - signalling for bitrate adaptation
    - RTP/AVP and RTCP reporting mandatory
    - RTP/AVPF included as optional RTP profile

- RTCP Extended Reports included
- update of PSS UAProf vocabulary and RDF schema to identify the PSS base applications (pure RTSP/RTP-based streaming, download, and SMIL presentation) and to express detailed client capabilities for all Rel-6 functionalities

Also, progressive downloading (playing while downloading) is included as new feature in Rel-6 PSS.

The following functionalities have been moved from TS 26.234 into their own TSs for Rel-6: 1) 3GPP file format (3GP) moved to TS 26.244 - approved at SA#23, 2) 3GPP Timed text format moved to TS 26.245 - brought for approval to SA#24, and 3) 3GPP SMIL Language Profile moved to TS 26.246 - brought for approval to SA#24.

Complementing CR(s) to TS 26.234 are still expected for SA#25, e.g., on Digital Rights Management extensions (RTP payload format for encryption, integrity protection of RTP).

2.2.2 Video codecs

Except for one company, SA4 has agreed ITU-T H.264 (MPEG-4 AVC) as the working assumption for recommended ("should be supported") video codec for adoption to PSS - and also to other services: MMS, PS conversational applications and 3G-324M (CS multimedia terminal).

Working assumptions on H.264 (AVC) levels and profiles for each of the services also exist. Draft specification text to adopt H.264 (AVC) for PSS (into TS 26.234), MMS (TS 26.140) and PC conversational applications (TS 26.235) and also on the impact to File Format (TS 26.244) have been prepared and found agreeable for all in SA4 except for one company. Some technical details also remain to be solved. Further discussions are needed to resolve these at next SA4 meeting to complete the video codec definition for Rel-6.

At SA4#31, one company still argued that the H.264 (AVC) codec efficiency was not proven, complexity of the encoder is an issue, and the quality improvement still not fully quantified. Also two other companies saw further testing useful. Except for these companies, the rest of SA4 sees that sufficient evidence has been already presented in SA4 and no additional data is needed to adopt H.264 (AVC) as a recommended video codec for PSS (and for the other above mentioned services).

2.2.3 Audio codecs

As explained to SA#23 (and as was found agreeable there), SA4 intends to recommend ("should be supported") two audio codecs for PSS:

- Enhanced aacPlus
- Extended AMR-WB

Since SA#24, draft specifications for both codecs have been prepared, and these are presented for information in Tdocs SP-040425 until SP-040433.[2]

SA4#31 formally agreed on the selection of these two recommended audio codecs. Upon agreeing on the codecs in SA4, draft versions of the new codec specifications were given for review to SA4. An SA4 ad-hoc meeting on audio codecs was scheduled for June 4th (still before SA#24) to review both the critical verification work and to finalise the review of the new audio codec TSs. SA4#31 gave the ad-hoc meeting the authority for approving the verification work results and the new audio codec TSs on behalf of SA4. Presentation of the codec selection (CR to TS 26.234 to define the new codecs for PSS) and draft specifications for approval already at SA#24 was targeted. However, this was set pending on approval of the codecs to pass "critical" codec verification and agreement on the new TSs at the SA4 audio codec ad-hoc meeting.

SA4#31 also requested the codec proponents to declare by 1st June their expectation of complexity of 16 bit fixed-point implementation (using the ETSI basic operator library) of their respective audio codec candidates, as the complexity verification (and selection testing) is based on using the floating-point code. This was requested only as additional information to be used for informative purposes and not within the formal codec selection process. Both proponents explained that they are committed to provide fixed-point implementation offering audio quality not significantly different from the floating-point implementation and both also expect the fixed-point implementation to meet the design constraints set for the floating-point implementation.

The "critical" verification carried out for the two codec candidates between SA4#31 and SA#24 consisted of the following verification items:

1. Verification of bit-exactness of C-code (in specifications) to the executable used for selection testing and to the executable used for freezing the codec (delivered to ETSI before testing started); over the

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[2] The final versions of the TSs will contain for both codecs the floating-point C source codes (for both encoder and decoder); the C-code to be delivered to MCC immediately upon codec selection and approval of the specifications in SA. The PSS codec selection (CR to TS 26.234) and the new codec TSs are expected for approval at SA#25.

selection test audio material: Carried out by Siemens in collaboration with the ETSI MCC SA4 Secretary.

2. Output sampling rate at 8 kHz - the decoder to be able to produce an output signal at 8 kHz, irrespective of the input signal sampling frequency. Carried out by Siemens.

3. Complexity check against design constraints: Candidates cross-check, STMicroelectronics

4. Verification of the format of the C-code: Candidates cross-check, STMicroelectronics

5. Verification of error insertion device and error concealment used for testing: Candidates cross-check STMicroelectronics

6. Review of draft recommendations: by all organizations in SA4 (draft TSs were distributed over SA4 reflector)

The verification results were reviewed in the SA4 audio codec ad-hoc meeting on 4th June with the following conclusions:

- For item 1, Extended AMR-WB passed, but Enhanced aacPlus failed (in 3 out of 188 samples). (Coding Technologies proposed a solution to resolve the problems of bit-exactness by submitting a new verification executable. However, due to time constraints, procedural concerns (checksums), and the mandate of the ad-hoc, this was not accepted by Nokia and Ericsson.)

- Both candidates passed verification items 2-5. (Some minor problems were reported for the Enhanced aacPlus codec for item 2.)

- For item 6, the conclusion of the ad-hoc meeting was that the draft specifications should be presented only for information to SA#24, since they are not yet mature enough for presentation for approval. The following specific concerns were expressed:
    - Ericsson and Nokia felt unable to approve the enhanced aacPlus specifications because the decoder is specified by reference to MPEG only, which would prevent 3GPP from applying CRs to the specification and which would make the decoder specification of enhanced aacPlus unclear to whether it can decode low bit rate AAC+ bitstreams. It was also felt by Ericsson that a codec that failed a bit exactness test is not eligible for specification approval. Clarification was requested.
    - Coding Technologies felt unable to approve the AMR-WB+ codec specification because it was unclear whether the specified codec would operate inline with the AMR-WB+ design constraints and whether it would comply with the complexity figures used in the selection process.

The above identified issues are aimed to be solved at SA4#32, with the target to bring the codec specifications for approval at SA#25 with a corresponding CR to TS 26.234 (to define the new codecs for PSS).

Other remaining audio codec work consists of completing the remaining "non-critical" verification and characterisation tasks. These include e.g. detailed checking of the C-code for any remaining bugs, complete detailed complexity analysis, calculation of frequency response, checking for special input voices and background noises. Also, fixed-point implementations of the codecs will be produced. Compliance requirements to specifications also remain to be discussed and completed by SA#25. A TR on audio codecs performance characterisation will be prepared to give information of the performance of the two recommended codecs (based on selection tests and further testing). This TR, when ready, will be referenced in TS 26.234 to give the readers a pointer into the TR where the performance of the two codecs is explained.

Table 4 lists the output specification for this WI. Table 5 lists separately the output from audio codec work.

Deliverable	Title	Prime resp. WG	2nd resp. WG	Comment/Status	TSG-SA approval target
CRs to TS 26.233	Transparent end-to-end PSS; General description	SA4	SA2	To be updated based on the content of PSS Rel-6.	SA#25 (September 2004)
CRs to TS 26.234	Transparent end-to-end PSS; Protocols and codecs	SA4	SA2	CR presented for approval at SA#24 bringing most Rel-6 changes into this TS. Some CRs are still expected (at SA#25).	SA#25 (September 2004)
TS 26.244	Transparent end-to-end PSS; File Format	SA4	SA2	Version 1.0.0 presented for information at SA#22. Version 2.0.0 approved at SA#23.	SA#23 (March 2004)
TS 26.245	Transparent end-to-end PSS; Timed Text Format	SA4	SA2	Version 2.0.0 presented for approval at SA#24.	SA#25 (September 2004)
TS 26.246	Transparent end-to-end PSS; SMIL Language Profile	SA4	SA2	Version 1.0.0 presented for information at SA#22. Version 2.0.0 presented for approval at SA#24.	SA#25 (September 2004)
CRs to TR 26.937	Transparent end-to-end PSS; RTP Usage Model	SA4		To be updated based on the content of PSS Rel-6. CR presented at SA#23.	SA#25 (September 2004)
CRs to TS 22.233	Stage 1	SA1		Under SA1 responsibility.	
Possible new TS	Stage2 (non-transparent aspects)	SA2		To be produced by SA2, if needed.	

Table 4: Status list of output TSs/TRs/CRs for Packet Switched Streaming Rel-6

Deliverable	Title	Prime resp. WG	2nd resp. WG	Comment/Status	TSG-SA approval target
New audio codec TS(s)	(Several enhanced aacPlus and AMR-WB+ TSs)	SA4	-	TSs presented for information at SA#24.	SA#24 (June 2004); to be moved to SA#25 (September 2004)
CRs to TSs 26.234 and 26.140	Transparent end-to-end PSS; Protocols and codecs, MMS; Media formats and codecs	SA4	SA2	CR to TS 26.234 aimed to be presented for approval at SA#25. MMS codec selection still open in SA4 - see Section 2.3.	SA#24 (June 2004); to be moved to SA#25 (September 2004)

Table 5: List of output TSs/TRs/CRs for audio codecs.

2.3 MMS Enhancements: MMS formats and codecs

During SA4#31, MMS audio codec selection was debated extensively. The main debate took place during SA4 audio codec ad-hoc group session, where most companies present stated preference for choosing one default ("shall be supported" i.e. mandatory support) MMS codec. This was seen bringing the benefit of reducing implementation costs. Some companies stated it also guaranteed interoperability. Some companies however pointed out that interoperability to terminals of earlier releases is not guaranteed. During SA4#31, support was given also for other options than one default codec, e.g., for two recommended codecs, or one default encoder and two default decoders.

Both candidate audio codecs (Enhanced aacPlus and Extended AMR-WB) were seen by SA4 as having merits depending on the bit-rate and content type as was shown in the PSS/MMS codec selection results and analysis presented at SA#23 in Tdocs SP-040073 and SP-040072. Both codecs also met all the PSS/MMS design constraints and the requirements for performance. Based on the selection procedure in SA4, both codecs exceeded the quality requirements and are from this perspective valid to become selected; choosing between them is difficult and a matter of preferences between bit-rates and content types. Like for PSS, SA4 was not therefore able to reach consensus on which codec of the two candidates to choose for MMS.

As no agreement on single MMS codec could be reached at SA4#31, a proposal for defining two recommended codecs for MMS (like for PSS) was made by a number of companies. Most companies expressing opinion in SA4 supported the proposal, but among these many still expressed clear preference for one default codec for MMS - but felt that in this situation two optional codecs is acceptable as a way forward. Some companies requested more time for considering the proposal of two recommended codecs. Therefore, the proposal was put for approval by correspondence after SA4#31 (by Wednesday 26th May). Three objections were then received (from T-Mobile, Telecom Italia and Orange) and, hence, the proposal was not agreed by SA4. Guidance from SA and/or from relevant WGs (T2, SA1 - on use cases) would likely be useful.

On MMS video codecs, except for one company, SA4 has agreed H.264 (AVC) as working assumption to be adopted as recommended ("should be supported") video codec for MMS. (See more discussion on video codecs in Section 2.2.2)

Deliverable	Title	Prime resp. WG	2nd resp. WG	Comment/Status	TSG-SA approval target
CRs to TS 26.140	MMS; Media formats and codecs	SA4	SA2, T2	Audio and video codec selection in progress.	SA#25 (September 2004)

Table 5: Status list of output TSs/TRs/CRs for MMS Rel-6

2.4 Extended AMR-WB codec (AMR-WB+)

AMR-WB+ codec developed under this work item is considered as candidate codec for PSS and MMS. The work in this WI is related to ongoing SA4 audio codec selection work for PSS and MMS as the AMR-WB+ codec is considered as one candidate for PSS and MMS audio codec and the testing of all codec candidates has been carried out as combined testing. For the finalisation of AMR-WB+ codec specifications and presentation to SA, see the PSS and MMS audio codec work status in Sections 2.2 and 2.3 above.

2.5 Speech Recognition and Speech Enabled Services: Codec Work to Support Speech Recognition Framework for Automated Voice Services

The verification work for the two candidate codecs has been now completed. Both codecs met the requirements (bit-exactness of the codec in specifications against the one used during selection testing, and verification of implementation complexity to meet design constraints). Therefore, SA4 asks SA approval for SES codec selection:

- DSR Extended Advanced Front-end ("should be supported")
- AMR or AMR-WB ("may be supported"); with substantial performance advantage from DSR noted

This agreement on codecs was reached already at SA4#30 and was brought for information to SA#23 in SES codec selection report in Tdoc SP-040075. Now, after completing the verification work, formal SA approval is requested for the codec selection. The related CRs to TSs 26.235 and 26.236, defining the use of SES codecs, are presented for approval in Tdocs SP-040356. The only new SES codec specification TS 26.243 "ANSI-C code for the Fixed-Point Distributed Speech Recognition Extended Advanced Front-end" has been finalised and is brought for approval in Tdoc SP-040343. (Draft version of the new TS and of the intended formulation of the two CRs were presented for information at SA#23. Some editorial improvements have been done in SA4 since then.)

As further work on SES codecs, a TR is planned to be produced on SES codec characterisation. This would be based on the codec test results obtained during the codec selection and verification phases. This TR, when ready, will be referenced in TSs 26.235. The SA4 SES codec work is completed apart from this "non-critical" TR.

Table 7 lists the intended output specifications and their status.

Deliverable	Title	Prime resp. WG	2nd resp. WG	Comment/Status	TSG-SA approval target
CRs to TS 26.235	PS Conversational Multimedia Applications; Default Codecs	SA4	SA2, T2	A document containing draft CR presented for information at SA#23 in Tdoc SP-040076. With some editorial updates, the CR is presented for approval at SA#24.	SA#24 (June 2004)
CRs to TS 26.236	PS Conversational Multimedia Applications; Transport Protocols	SA4	SA2, T2	A document containing draft CR presented for information at SA#23 in Tdoc SP-040076. With some editorial updates, the CR is presented for approval at SA#24.	SA#24 (June 2004)
TS 26.243	Software documentation for fixed-point DSR Extended Advanced Front-end	SA4		Version 1.0.0 was presented for information at SA#23. Version 2.0.0 is presented for approval at SA#24.	SA#24 (June 2004)

Table 7: Status list of output TSs/TRs/CRs for Codec Work to Support Speech Recognition Framework for Automated Voice Services

At SA#23, the issue of possibly raising an new WI on SES codecs in CS domain was mentioned since the current SA4 WI covers only the PS domain. No such WI was proposed at SA4#31. At SA#23 it was also noted that a new Stage 1 WI would then also be needed in SA1 on service requirements for SES in CS domain.

2.6 Media Codecs and Formats for IMS Messaging and Presence

A first "skeleton" working draft of TS 26.141 "IMS Messaging and Presence; Media Formats and Codecs" was prepared at SA4#28 (September 2003). Since then there have been no contributions or progress for this WI.

Table 8 lists the status of the output specification.

Deliverable	Title	Prime resp. WG	2nd resp. WG	Comment/Status	TSG-SA approval target
TS 26.141	IMS Messaging and Presence; Media formats and codecs	SA4	SA2, CN1	First skeleton working draft prepared at SA4#28 (September 2003). No progress since then. Lack of input.	TSG-SA#25 (September 2004)

Table 8: Status list of output TSs/TRs/CRs for Media Codecs and Formats for IMS Messaging and Presence

2.7 Definition of MBMS user services, media codecs, formats and transport/application protocols using Multimedia Broadcast/Multicast Service (MBMS)

TS 26.346 "MBMS Protocols and Codecs" has been progressed. The intention is that a draft version of the TR will be presented for information at SA#25 in September. Finalisation of MBMS work is expected to take until December 2004.

Application level Forward Error Correction (FEC) and proposed candidate solutions have been discussed. A document on simulation guidelines is being prepared to be used in the evaluation of the FEC proposals. Feedback for initial simulation guidelines document was received from RAN and GERAN WGs, and finalisation is ongoing with the relevant WGs. The guidelines will be then used to compare the different FEC proposals. It is expected that at the next meeting SA4 will evaluate the competing FEC schemes with a target to make selection. SA4#31 agreed that FEC should be supported in an MBMS service infrastructure. Requirements for FEC support for the terminal remain to be discussed at next SA4 meeting.

For reliable transmission, SA4 agreed that point-to-point (ptp) repair is needed in addition to FEC. Point-to-multipoint (ptm) repair is for further study. Working assumption for ptp repair (based on time randomization of requests and randomization of requests among a set of ptp repair servers) was agreed, and also the format for performing these requests.

Besides issues for reliable transfer, protocol definitions have been progressed. MBMS download delivery has already earlier been agreed to be based on IETF FLUTE-protocol as the working assumption. Clarifications have now been made on the use of dowload delivery methods (e.g. requirements set for support for the different features in FLUTE) and on the use of SDP.

Discussion on security issues has continued with SA3 e.g. on adopting SRTP (currently considered optional for integrity protection). SA3 has proposed a joint meeting with SA4 on MBMS security issues. SA4 has therefore planned an ad-hoc meeting on MBMS security related issues on 23rd August (to be confirmed) and has invited SA3 delegates to participate.

There has not yet been extensive debate on MBMS codecs due to other still open MBMS issues e.g. on reliable transfer. Nevertheless, some initial proposals have been made for adopting H.263 or H.264 (AVC) as a single default video codec for MBMS, and the use of the new audio codecs. Harmonisation with other services is felt important, and the developments and performance analysis in new codec selections for other services (PSS, MMS) are being followed.

Deliverable	Title	Prime resp. WG	2nd resp. WG	Comment/Status	TSG-SA approval target
TS 26.346	MBMS Protocols and Codecs	SA4	SA2, SA3	Draft version under development. FEC and other methods for reliable transport under study.	SA#26 (December 2004); or earlier by focusing the content of TS 26.346
TS 22.246	MBMS user services; Stage 1	SA1			Approved at SA#22

Table 9: Status list of output TSs/TRs/CRs for Definition of MBMS user services, media codecs, formats and transport/application protocols using Multimedia Broadcast/Multicast Service (MBMS)

2.8 Codec Enhancements for Packet Switched Conversational Multimedia Applications

This new WI approved at SA#23 considers enhancements for the set of codecs (and the related transport protocols) for PS Conversational Multimedia Applications. Except for one company, SA4 has agreed H.264 (AVC) as working assumption to be adopted as recommended ("should be supported") video codec for PS conversational multimedia applications. Draft specification text to adopt H.264 (AVC) for PC conversational applications (into TS 26.235) has been prepared and found agreeable for all in SA4 except for one company.

Deliverable	Title	Prime resp. WG	2nd resp. WG	Comment/Status	TSG-SA approval target
CRs to TS 26.235	PS Conversational Multimedia Applications; Default Codecs	SA4	SA2, T2	Draft specification text to adopt H.264 (AVC) prepared and found agreeable for all in SA4 except for one company.	SA#25 (Sept 2004)
CRs to TS 26.236	PS Conversational Multimedia Applications; Transport Protocols	SA4	SA2, T2		SA#24 (Sept 2004)

Table 10: Status list of output TSs/TRs/CRs for Codec Enhancements for Packet Switched Conversational Multimedia Applications

2.9 3G-324M Improvements

This new WI approved at SA#23 considers a number of backwards-compatible updates to the 3G-324M (CS multimedia telephony service terminal). At SA4#31, addition of optional H.264 (AVC) and AMR-WB support was proposed. Draft CR text to TS 26.111 was formulated on optional H.264 (AVC) and AMR-WB at SA4#31 taking into account the discussion during the meeting. No agreements were yet taken and the draft CR was provided for information and delegates were invited to comment until SA4#32 for finalisation of the CR.

Deliverable	Title	Prime resp. WG	2nd resp. WG	Comment/Status	TSG-SA approval target
TS 26.111	Codec for CS Multimedia Telephony Service; Modifications to H.324	SA4		Draft CR on of optional H.264 (AVC) and AMR-WB support prepared during SA4#31. Finalisation left for SA4#32.	SA#25 (Sept 2004)
TR 26.911	Codec for CS Multimedia Telephony Service;Terminal Implementor's Guide	SA4			SA#25 (Sept 2004)

Table 11: Status list of output TSs/TRs/CRs for 3G-324M Improvements

3. Maintenance of Releases

During recent SA4 meetings Optimisation of Voice over IMS has been discussed due to request from SA2 to study and comment on how to efficiently handle RTCP associated to an RTP flow (to obtain bandwidth savings and avoid disruptions).

RTCP is required for instance to synchronise multiple media streams, and in multi-party RTP sessions. However, for a point-to-point speech only service, SA4 sees that RTCP is not always required.

SA4 recommends that RTCP packets should be sent for all types of multimedia sessions except for point-to-point speech only sessions. For point-to-point speech only sessions, a UE should not send RTCP packets. This avoids RTCP disrupting the RTP speech flow and causing impairment to speech quality.

This application level solution solves Voice over IMS RTCP usage problems, but only for point-to-point speech only service. SA4 has informed SA2, RAN2 and RAN3 of the above SA4 view (in LS sent in mid-April, approved by correspondence in SA4) and asked these groups to continue to work on solutions for efficient transport of RTCP.A CR to TS 26.236 (Rel-5 and Rel-6) on the issue is brought for approval in Tdoc SP-040357.

4. Communication with other WGs/TSGs/groups

Table 12 gives a complete list of the LSs sent out (to other 3GPP WGs/TSGs and 3GPP external groups) since SA4#30.

Tdoc no.	Title	Intended for	Copy to
TD S4-040203*	Reply LS to LS on Optimisation of Voice over IMS	TSG SA WG2, TSG RAN WG2	RAN WG3
TD S4-040320	Reply LS on "Answer to MBMS ARP Support in UTRAN"	TSG RAN WG2, TSG RAN WG3, TSG SA WG2	TSG GERAN, TSG CN WG1
TD S4-040324	Reply LS on AMR mode selection for MMS	OMA Messaging Working Group (MWG) Multimedia Messaging Subgroup (MMSG)	3GPP2 TSG-C
TD S4-040355	Reply LS on MBMS support in UTRAN	TSG RAN WG2, TSG SA WG2	TSG GERAN, TSG CN WG1, TSG RAN WG3
TD S4-040322	Reply LS on MBMS security issues	TSG SA WG3	TSG SA WG2, OMA DL+DRM
TD S4-040356	Response LS on Multiple MBMS Issues	TSG RAN WG1, TSG RAN WG2, TSG RAN WG3, TSG GERAN, TSG GERAN WG2	
TD S4-040347	LS on Optimisation of Voice over IMS	TSG CN WG1, TSG RAN WG2	
TD S4-040309	Liaison statement on DRM protection for PSS	TSG SA WG3	OMA-BAC DL+DRM, ISMA

*) drafted in PSM ad-hoc meeting in April and approved by correspondence in SA4 (before SA4#31).

Table 12: SA4 LSs sent out since TSG-SA#23

The main issues in the LSs are (in the order of Table 12):

- For optimisation of Voice over IMS, SA4 recommends that clients should not use RTCP for a point to point speech only service (to avoid disruptions and to obtain bandwidth savings). This application level solution solves Voice over IMS RTCP usage problems only for point to point speech only service, and is not possible for other voice service scenarios. SA4 therefore asks SA2 and the RAN2 to continue to work on solutions for efficient transport of RTCP packets. (See Section 3 of this report for a related CR.)

- SA4 has confirmed that MBMS Allocation/Retention Priority support could be provided by the MBMS User Service entity at Session Start together with other Quality-of-Service parameters.

- OMA (MWG and MMSG) requested SA4 to select or recommend a single AMR mode for speech attachments in MMS and to consider whether such a selection/recommendation could be made in 3GPP and 3GPP2 specifications. SA4 responded to OMA that MMS clients in the mobile terminals are required to support all AMR modes and, hence, the MMS originator may select any AMR mode appropriate for each purpose. Given the decoding capability of the mobiles there is also no need for transcoding between AMR modes. Therefore, SA4 does not see need to define default or recommended AMR mode for MMS.

- SA4 confirms the RAN2 assumptions on MBMS support in UTRAN.

- Communication has continued with SA3 on security issues in MBMS, e.g., on the suitability and feasibility of using SRTP for protecting MBMS streaming data (where SA4 have already adopted SRTP as optional protocol for integrity protection purposes). On SA3 request, SA4 has planned an ad-hoc meeting on MBMS security related issues on 23rd August (to be confirmed) and has invited SA3 delegates to participate.

- Communication on simulation guidelines for the evaluation of FEC methods for MBMS download and streaming services has continued with relevant RAN and GERAN WGs. Updated guidelines document was sent to the relevant WGs for comments and finalisation.

- SA4#31 agreed a CR to TS 26.235 on "RTCP usage for IMS". Use of RTCP is not recommended for a point to point speech only service. SA4 sent LS to CN1 and RAN2 informing them about the CR. (The CR is brought for SA#24 approval in Tdoc SP-040357.).

- SA4 has clarified to SA3 the progress in support of DRM protection for PSS in relevant SA4 specifications (TSs 26.234 and 26.244). TS 26.234 will contain the necessary extensions for DRM protection of PSS (to be updated by CR into TS 26.234 at SA#25). It will include all details on signalling encrypted media as well as the transport format, the mechanism for integrity protection and key handling based on SRTP. TS 26.244 includes support for carrying encrypted and protected media, as well as support for streaming servers to apply integrity protection using SRTP.

5. Miscellaneous

- On SA2 request, SA4 took the task (at SA4#30) to co-ordinate selecting a single preferred AMR configuration for CS speech telephony, i.e., one common configuration for the AMR Codec Types that can be used on all channels in GERAN and UTRAN. The harmonisation of AMR configurations for CS Speech in Release 6 is seen a valuable enhancement for systems supporting TFO/TrFO. At SA4#31, the choice of codec modes and factors impacting the choice were debated. Further discussion is needed and will take place via the SA4 e-mail reflector to come into agreement at next SA4 meeting.

6. Documents presented for information

The following audio codec draft TSs are presented for information:

SP-040425	3GPP TS 26.273: "Fixed-point ANSI-C code for the Extended Adaptive Multi-Rate - Wideband (AMR-WB+) codec" Version 1.0.0 (Release 6)	SA WG4	7.4.1	Information
SP-040426	3GPP TS 26.290: "Audio codec processing functions; Extended Adaptive Multi-Rate - Wideband (AMR-WB+) codec; Transcoding functions" Version 1.0.0 (Release 6)	SA WG4	7.4.1	Information
SP-040427	3GPP TS 26.304: "Floating-point ANSI-C code for the Extended Adaptive Multi-Rate - Wideband (AMR-WB+) codec" Version 1.0.0 (Release 6)	SA WG4	7.4.1	Information
SP-040428	3GPP TS 26.401: "General audio codec audio processing functions; Enhanced aacPlus general audio codec; General description" Version 1.0.0 (Release 6)	SA WG4	7.4.1	Information
SP-040429	3GPP TS 26.402: "General audio codec audio processing functions; Enhanced aacPlus general audio codec; Additional decoder tools" Version 1.0.0 (Release 6)	SA WG4	7.4.1	Information
SP-040430	3GPP TS 26.403: "General audio codec audio processing functions; Enhanced aacPlus general audio codec; Encoder specification; Advanced Audio Coding (AAC) part" Version 1.0.0 (Release 6)	SA WG4	7.4.1	Information
SP-040431	3GPP TS 26.404: "General audio codec audio processing functions; Enhanced aacPlus general audio codec; Encoder specification; Spectral Band Replication (SBR) part" Version 1.0.0 (Release 6)	SA WG4	7.4.1	Information
SP-040432	3GPP TS 26.405: "General audio codec audio processing functions; Enhanced aacPlus general audio codec; Encoder specification; Parametric stereo part" Version 1.0.0 (Release 6)	SA WG4	7.4.1	Information
SP-040433	3GPP TS 26.410: "General audio codec audio processing functions; Enhanced aacPlus general audio codec; ANSI-C code" Version 1.0.0 (Release 6)	SA WG4	7.4.1	Information

7. Approval requested

SA4 requests SA#24 to approve the following:

Performance characterisation of default codecs for PS conversational multimedia applications:

SP-040342	3GPP TR 26.935: "Packet Switched Conversational Multimedia Applications; Performance Characterisation of Default Codecs" Version 2.0.0 (Release 6)	SA WG4	7.4.3	Approval

PS Streaming (PSS) Rel-6:

SP-040344	3GPP TS 26.245: "Transparent end-to-end packet switched streaming service (PSS); Timed text format" Version 2.0.0 (Release 6)	SA WG4	7.4.3	Approval
SP-040345	3GPP TS 26.246: "Transparent end-to-end packet switched streaming service (PSS); 3GPP SMIL Language Profile" Version 2.0.0 (Release 6)	SA WG4	7.4.3	Approval
SP-040434	CRs TS 26.234 on Addition of Release 6 functionality	SA WG4	7.4.3	Approval

Speech Recognition and Speech Enabled Services: Codec Work to Support Speech Recognition Framework for Automated Voice Services:

SP-040343	3GPP TS 26.243: "ANSI-C code for the Fixed-Point Distributed Speech Recognition Extended Advanced Front-end" Version 2.0.0 (Release 6)	SA WG4	7.4.3	Approval
SP-040356	CRs TS 26.235 and TS 26.236 on the introduction of the DSR codec (Release 6)	SA WG4	7.4.3	Approval

Maintenance of releases:

SP-040357	CRs TS 26.236 on "RTCP usage for IMS" (Release 5 and Release 6)	SA WG4	7.4.3	Approval