ETSI SMG11 **Tdoc SMG11 AMR/S4 417/99**

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Title: **COMSAT AMR NS Selection Host Laboratory Report**

Source*: **COMSAT Laboratories**

Summary

This document presents a brief report of the host lab activities conducted by COMSAT for the ETSI/AMR Noise Suppression (NS) Selection Tests.

1. Introduction

COMSAT Laboratories and ARCON Corporation were contracted to perform the host laboratory function for the AMR Characterization Phase. The responsibilities for the host laboratory activity was defined in the AMR NS Selection Subjective Test Plan [1] and in the AMR NS Selection Processing Test Plan [2]. As of the date of the contract, version 1.0.0 of the Subjective Test Plan and version 0.5 of the Processing Test Plan were in force. As the work progressed, a number of ambiguities and mistakes were corrected, and as of the completion of the work in the November 99, version 2.2 of the Subjective Test Plan and 0.11 of the Processing Test Plan were in force.

COMSAT performed the Host Lab function in full compliance with [1] and [2]. COMSAT also cooperated with ARCON to implement a set of processing crosscheck procedures [3], which were very useful for improving consistency of the processing performed by both host laboratories and for ensuring adherence to the test design by SMG11SQ.

The assignment of Listening Laboratories to the Host Laboratories is shown in Table 1.

Table 1:
Assignment of Listening Laboratories to the Host Laboratories

	Host Laboratory	
Experiment	**ARCON(1)**	**COMSAT**
1A	Nortel	COMSAT(2)
2A	ARCON	COMSAT(3)
3A,3B,3C	ARCON	FUB
4A,4B,5A,5B	Nortel	COMSAT(2)
6A,7A	AT&T	AT&T(2)
8A,9A	Nortel	AT&T(4)
10A	ARCON	COMSAT

Notes:
(1) All experiments processed by ARCON were performed in (North-American) English
(2) Test performed in Spanish
(3) Test performed in French
(4) Test performed in Chinese (Mandarin)

The host laboratory activity was organized in three phases: pre-processing, processing, and post-processing.

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In the *pre-processing phase*, the speech material received from the listening laboratories was pre-processed: levels were equalized, speech weighting was applied, leading silence was appended, and noise material (for experiments 3 through 10) was added to the speech. In this phase, 16 kHz-sampled material was used as input signals and 8 kHz pre-processed material was produced. The pre-processed material was then distributed to the six NS proponents. An additional deliverable for this phase was the clean background version of the speech material used in Experiments 3 though 10 for the voice activity factor (VAF) measurement.

In the *processing phase*, the host laboratories were responsible for processing the pre-processed material through the reference conditions for each of the test experiments. Also in this phase, but outside the responsibility of the host laboratories, the NS proponents were responsible to processes the pre-processed material through their candidate algorithms through the different conditions called for in each experiment and to crosscheck the processing performed by another NS candidate. This phase worked with speech materials in the 8 kHz domain.

In the *post-processing phase*, the processed material was further processed through final stages to produce files in the 16 kHz domain according to the different specifications for each experiment. This phase also included the blinding of the NS candidate designations into a numeric representation 1..6. In particular, Experiment 1 material was derived from material processed for experiments 2, 4, and 5, and retained the 2-second leading audio and limited speech segments to 4 seconds (one sentence); for the other experiments, the 2-second audio lead was stripped.

Post-processed speech was organized in different groups and CD-ROMs were cut and delivered to the listening laboratories. True identity of the NS algorithms has been concealed from the listening laboratories.

Overall, the activity suffered from initial delays, which were also reflected in the delivery of the material to the listening laboratories. On the COMSAT side, speech material was delivered to FUB in the last day within the schedule (22/Oct), to AT&T with a one-week delay (29/Oct), and to COMSAT with delays varying from ½ week to 2 ½ weeks.

2. Input Deliverables

The initial deliverable materials received by COMSAT are summarized in Table 2, together with an indication of problems identified.

Table 2:
Deliverables provided to COMSAT as input for the host laboratory function

Listening Lab	***NDA?***	***Media***	***On time?***	***Notes/Problems observed & corrected***
Pre-processing phase				
AT&T	No	FTP	Yes	
FUB	No	FTP	Yes	
COMSAT	No	CD-ROM	Yes	
Post-processing phase				
NS candidates*	No	CD-ROM	Yes	Processed speech
Crosscheck activity**				
ARCON	No	FTP	Yes	Only files necessary for crosscheck activity
AT&T	No	FTP	Yes	Files as necessary for crosscheck activity
Conexant	No	FTP	Yes	Files as necessary for crosscheck activity
Nortel	No	FTP	Yes	Files as necessary for crosscheck activity
Other materials				
Noise files (ARCON)	No	CD-ROM, FTP	Yes	CD-ROM distribution superseded by FTP distribution
Error Patterns (Ericsson)	No	FTP	Yes	Same as from the ETSI/AMR Characterization Tests
AMR channel simulator (Ericsson)	Yes	FTP	Yes	Executables replaced prior to actual start of processing to fix an incorrect channel coding for DTX operation.
ETSI server tools	No	FTP	Yes	Same as from the ETSI/AMR Characterization Tests, which were provided by ARCON on ETSI's behalf
AMR C code	No	E-mail	Yes	Provided by ETSI for the performance of the host laboratory function

***** Candidates were Ericsson, Matra-Nortel, Mitsubishi, Motorola, Nokia, and Siemens.
**** Note:** material exchanged via ARCON using PGP-encrypted ZIP files deposited in ARCON's FTP site. Only files necessary for crosscheck activity were exchanged.

3. Organization of work

The work was organized in input data storage, script generation, speech processing, output data storage, and CD-ROM production. Data storage was performed in a Windows NT workstation, which also centralized script generation. Speech processing was split between the Windows NT workstation and a 333 MHz SPARC Sun workstation running under Solaris 7. CD-ROM production was performed in a Windows NT workstation using a 4x4x16 Yamaha CD-R/RW recorder and Adaptec's "Easy CD Creator" software version 3.5as.

The script generation procedure was based on a hierarchical approach, whereby processing steps were systematically generated from more abstract levels to the lower level of program calls, the latter being saved in files that could be run either from a Unix shell or as MS-DOS "batch" files. Scripting was divided in three groups, one for each host laboratory phase (pre-processing, processing, and post-processing). This approach allowed for very-well controlled script generation, at the expense of sub-optimum processing efficiency (i.e. processing time and intermediate data storage). The trade-off between efficiency and process integrity was balanced towards the latter, since the AMR NS Selection experiments were large and complex (in terms of variability of individual processing call options).

Processing in each phase consisted of two steps: crosschecking and main processing. Crosschecking batch files were generated using the same Unix scripts that were used to produce the main processing batch files. This step ensured that the interpretation and implementation of the scripts (which were used for both processing phases) was consistent between the two host laboratories, and adherent to the test plans. The crosscheck hence allowed the elimination of any systematic and interpretation errors and ambiguities, and cleared the way for the main processing phase.

As an additional precaution, each speech file in the created CD-ROMs had its initial 3 seconds listened to by an expert listener in COMSAT's premises, to screen for any gross anomalies (wrong language, wrong byte order, etc). This also helped to minimize the chances that the delivered CD-ROM might not be readable in a CD-ROM drive different from the one used to create the disk.

4. Output Deliverables

Table 3 contains a summary regarding the processed material produced by COMSAT. Delivery is the date of delivery from COMSAT Labs; typically, the CD-ROMs where in the destination in one (within North America) or two days (Europe & Japan).

5. Lessons learned

- The crosscheck procedure was a very effective tool to ensure proper and consistent interpretation of the test plans, as regards the processing activities. This practice should be continued in future ETSI exercises.
- Software host laboratory using commonly defined tools has proven (once again) to be a reliable, efficient, and cost-effective method for codec assessment activities. This is particularly true if compared to hardware host laboratory activities conducted in the past.
- File naming convention for the source (pre-processed) files and processed files should include a listening laboratory identifier. This would add an additional protective measure against populating one listening laboratory material with speech from another laboratory. This can be easily accomplished by replacing the gender letter indication from the file name with a lab identifier, which can be accomplished provided that the list number is absolute for all talkers within a given experiment.

Table 3:
Deliverables provided by COMSAT to the listening laboratories and candidates.
All material was dully crosschecked

Listening Lab	*Reference*	*Media*	*Delivery*	*Notes*
AT&T	Post-processed speech	CD-ROM	29/Oct/99	One week delay
FUB		CD-ROM	22/Oct/99	3A also delivered via FTP
COMSAT		CD-ROM	25/Oct/99-09/Nov/99	½ to 2 ½ weeks delay

Candidates	*Reference*	*Media*	*Delivery*	*Notes*
Ericsson	Pre-processed speech	CD-ROM	17/Sep/99	- Supplemented by additional files for Experiment 2 (samples 7 through 12) for French (via FTP)
Matra-Nortel				
Mitsubishi				
Motorola				
Nokia				
Siemens				
Ericsson	VAF speech	CD-ROM	12/Oct/99	- Supplemented by a new distribution with corrected speech for level-variation conditions in experiment 10 (via FTP)
Matra-Nortel				
Mitsubishi				
Motorola				
Nokia				
Nortel				
Siemens				

6. Conclusion

COMSAT performed the host laboratory processing function in the AMR NS Selection Phase for AT&T, FUB, and COMSAT. COMSAT collaborated with ARCON to develop a common cross check procedure, and successfully crosschecked the ARCON-processed speech material for ARCON, Conexant, and Nortel. Complementarily, COMSAT had its processed speech successfully crosschecked by ARCON. The crosschecking activity allowed the resolution of a number of ambiguities and omissions in the subjective test plan and in the processing test plan [1,2], as well as ensured consistent and adherent implementation of the test speech processing by both host laboratory organizations.

COMSAT delivered the pre-processed speech material on time to the candidates, after crosschecking and internal verification. The prost-processed material was delivered on time for FUB, with one-week delay to AT&T, and ½ to 2 ½ weeks delay to COMSAT's Listening Facility. The material was delivered in CD-ROM medium, as well as by Internet File Transfer Protocol (FTP) to one listening laboratory.

Finally, some "lessons learned" observations were made towards future ETSI codec assessment activities, in particular emphasizing the importance of using of crosschecking procedures and added sanity-checking measures in software host labs.

References

[1] SMG11SQ, *"Test Plan for the AMR Specification for the AMR-NS Selection Phase"*; Tdoc SMG11 288/99.

[2] SMG11SQ, *"Processing Functions for the GSM AMR Noise Suppression Selection Tests"*; Tdoc SMG11 281R/99

[3] ARCON Corporation & COMSAT Laboratories, *"ETSI/AMR NS Selection Host Laboratory Crosscheck Procedures"*; Tdoc SMG11 418/99.