Source:	**Ericsson**
Title:	**Proposal for AMR-NS test plan (ACR)**
Document for:	**Discussion**
Agenda Item:	

X   Experiments 3a, 3b & 3c: Artifacts and Clipping Effects in Background Noise Conditions (ACR)

X.1   Introduction

These ACR experiments were prepared to test requirements 4.5.1.3 and 4.5.1.4 in the associated Section in Stage 1 Description (TS GSM 02.76 v. 2.0.0), i.e. No artifacts in residual noise, and No speech clipping and no reduction in intelligibility. These ACR experiments will be run for three types of acoustic background noise.

X.2   Test Factors and Conditions

The ACR test will be run for the following three types of acoustic background noise:
- A car noise that is stationary both in level and in spectrum.
- A street noise that is non-stationary in level but fairly stationary in spectrum.
- A babble noise that is fairly stationary in level but non-stationary in spectrum.

This results in a total of three ACR experiments with the different noise types in separate experiments. Within each experiment, a low and a high SNR level will be tested. The values for the low SNR are SNR_C = 6 dB for the car noise, SNR_S = 9 dB for the street noise, and SNR_B = 9 dB for the babble noise. The higher SNR will be equal to SNR + 6 dB for all three noise types. The noise samples will have been recorded in scenarios representative of the respective low SNR value for each noise type (i.e. SNR = 6 or 9 dB).

A coder tandem condition is included with each experiment. This condition is tested for the low SNR level only. All three experiments are run at AMR bit rate 12.2 kbit/s.

The following table shows the testing factors to be used in these experiments. A full list of test conditions is given in Section X.12.

Main Codec Conditions	#	Notes
Noise Suppresser Algorithms	1	
Codec	1	AMR
Codec Modes (FR/HR)	FR	12.2 kbps rate, 5.9 kbps rate
BERs	0	Clear channel, no transmission errors
Input level	1	nominal: -26dB relative to OVL
Acoustic Background Noise	3	Static Car @ 6dB, 12dB, 18dB
		Street @ 9dB, 15dB, 21dB
		Babble @ 9dB, 15dB, 21dB
Input Characteristic	1	GSM Filtered
Codec references	**#**	**Notes**
All Experiments	1	AMR wo/ NS
Other references	**#**	**Notes**
Direct		nominal level, GSM Filtered
MNRU, Exp 3a, 3b, 3c	5	nominal level, with background noise, GSM Filtered, Q= 6, 12, 18, 24, 30dB
Ideal Noise Suppression	12	3 levels for each SNR
Common Conditions	**#**	**Notes**
GSM Channel	0	NO channel model
Number of talkers	4	2 male + 2 female
Number of speech samples	28	6/ talker for the main test + 1/ talker for the Practice session
Listening Level	1	-15dBPa (79dB SPL) at ERP
Listeners	24	Naive Listeners
Randomizations	6	6 groups of 4 listeners
Rating Scale	1	Modified ACR Instructions
Replications	1	Original Presentation Only

Table X. 2.1: Factors and conditions for Experiments 3A, 3B, 3C

X.3   Preliminary Conditions

The following 16 preliminary test conditions are recommended. *[Note: This need revision]*

Cond.	resentation order	SNR value	Ideal NS (dB)	Trans-codings	Codec	Talker and Sample Number
P1	5	SNR	-	-	Direct	M1S07
P2	1	SNR	-	-	MNRU-12	M2S07
P3	3	SNR	-	1	AMR@12.2	M1S07
P4	7	SNR	6	1	AMR@12.2	M2S07
P5	6	SNR	10	1	AMR@12.2	F1S07
P6	2	SNR+6	4	1	AMR@12.2	F2S07
P7	4	SNR+6	8	1	AMR@12.2	F1S07
P8	8	SNR	-	2	AMR@12.2	F2S07
P9	14	SNR	-	-	Direct	F1S07
P10	10	SNR	-	-	MNRU-12	F2S07
P11	12	SNR	-	1	AMR@12.2	F1S07
P12	16	SNR	6	1	AMR@12.2	F2S07
P13	13	SNR	10	1	AMR@12.2	M1S07
P14	9	SNR+6	4	1	AMR@12.2	M2S07
P15	11	SNR+6	8	1	AMR@12.2	M1S07
P16	15	SNR	-	2	AMR@12.2	M2S07

Table X.3.1: List of preliminary conditions

X.4   *Speech Material*

The speech material should be as defined in Section 6.4 - Long Sentence Quads, with each sample containing 4 sentences. For each test condition there are:

> 6 samples / talker, each sample 16sec long w/ 4 sentences

> 24 unique sentences / talker

For the practice conditions there are:

> 1 sample / talker

> 4 unique sentences / talker

To reduce any speech material effect, each talkers' sample must be unique. For these experiments, the unique samples are not balanced across all condition, candidates and subject groups. The same sample numbers for each talker are used for common conditions within a subject group and changed across subject groups. For a given language, the same speech material must be used for the three experiments 3a, 3b and 3c.

Speech samples numbered from 01 to 06 should be used for the test conditions; speech samples numbered as 07 should be used for the Practice session.

The noise material and its mix with the speech material should be as defined in Section 6.10 and Section X.2.

X.5   Experimental Design

The design is based on a restricted randomization philosophy using 6 different randomizations, each one covered by a group of 4 of the 24 subjects. This means that up to 4 subjects can perform the experiment simultaneously.

Each subject will hear all of the conditions four times, once with speech from each of the four talkers. Over the experiment as a whole, each of the conditions will be paired with six different samples from each of the four talkers. Each of the six groups of subjects will hear different combinations of source material and condition.

X.6   Processing

Every condition has to be processed for each of the six stimuli of each of the four primary talkers. The actual samples used for each condition by each subject group are presented in Section X.12 Test Conditions.

X.7   Randomizations

[Note: This section needs revision based on the number of conditions]

Separate randomizations for each of the six subject groups are provided to reduce order effects and to minimize differences between the laboratories. There are six randomizations for the sub-experiments, one for each subject group. The same randomizations will be used for the three experiments (3a, 3b and 3c). Each one will therefore be used by four of the 24 subjects. Each randomization is balanced across 4 blocks of 36 stimuli to eliminate long sequences of similar conditions or identical talkers. The sequences provide for alternating male-female talkers. The randomizations can be found in Annex F.

X.8   Duration of the ACR Experiments 3a, 3b, and 3c

[Note: This section needs revision based on the number of conditions]

Each stimuli is 16 s speech sample + 5 s voting time or 21 seconds. For each of the three experiments there are 16 preliminary conditions x 21 seconds or 5.6 minutes for an introductory block. The test consists of 36 conditions x 4 talkers x 21 seconds or 50.4 minutes, presented as four 12.6 minute blocks of 36 stimuli for 56 minutes testing time / subject group. The 6 groups of 4 subjects require 5 hours and 36 minutes total testing time

To reduce the effects of subject fatigue, the four blocks should be separated by short comfort breaks.

Note that the above calculations do not include the time needed to give the subjects their instructions, or for comfort breaks.

X.9   Votes Per Condition

In each of the three experiments, every condition will have 24 subjects vote on one stimulus from each of four talkers, giving:

(24 subjects x 4 talkers) = 96 votes per condition

From past experience of ACR tests, this is the minimum number of votes per condition needed to give enough statistical certainty to differentiate the performance of one candidate process from another candidate process over the conditions and against the references.

X.10   Test Procedure

Factors important for the experimental environment are specified in section 6.5 and 6.6. As specified in section X.8, comfort breaks should be provided to reduce the effects of subject fatigue.

X.11   Opinion Scale

The question asked of the subject is a modification of the ACR Listening Quality Scale. The specific wording is designed to evaluate both the level of distortion of the speech and the presence of

artifacts in the residual background noise signal. The subjects will listen to each sample and after it has completed they will be asked to give their opinion. Annex A contains an example of the instructions for the subjects in English.

X.12   Test Conditions

[Note: There are no reference conditions for AMR/NS@5,9]

Cond.	SNR value	Ideal NS (dB)	Codec	Speech sample number (6 sequences)
1	SNR	-	Direct	4 3 4 5 6 1
2	SNR	-	MNRU-30	4 3 4 5 6 1
3	SNR	-	MNRU-24	4 3 4 5 6 1
4	SNR	-	MNRU-18	4 3 4 5 6 1
5	SNR	-	MNRU-12	4 3 4 5 6 1
6	SNR	-	MNRU-6	4 3 4 5 6 1
7	SNR	-	AMR@12.2	1 2 3 4 5 6
8	SNR	4	AMR@12.2	1 2 3 4 5 6
9	SNR	6	AMR@12.2	1 2 3 4 5 6
10	SNR	8	AMR@12.2	1 2 3 4 5 6
11	SNR+6	-	AMR@12.2	2 3 4 5 6 1
12	SNR+6	4	AMR@12.2	2 3 4 5 6 1
13	SNR+6	6	AMR@12.2	2 3 4 5 6 1
14	SNR+6	8	AMR@12.2	2 3 4 5 6 1
15	SNR+12	-	AMR@12.2	3 4 5 6 1 2
16	SNR+12	4	AMR@12.2	3 4 5 6 1 2
17	SNR+12	6	AMR@12.2	3 4 5 6 1 2
18	SNR+12	8	AMR@12.2	3 4 5 6 1 2
19	SNR	-	AMR/NS@12.2	1 2 3 4 5 6
20	SNR	-	AMR/NS@5.9	1 2 3 4 5 6
21	SNR+6	-	AMR/NS@12.2	2 3 4 5 6 1
22	SNR+6	-	AMR/NS@5.9	2 3 4 5 6 1
23	SNR+12	-	AMR/NS@12.2	3 4 5 6 1 2
24	SNR+12	-	AMR/NS@5.9	3 4 5 6 1 2
Note:	Experiment 3a: Car noise with SNR = SNR_C = 6 dB, Experiment 3b: Street noise with SNR = SNR_S = 9 dB Experiment 3c: Babble noise with SNR = SNR_B = 9 dB			