



**Universal Mobile Telecommunications System (UMTS);
LTE;
Codec for Enhanced Voice Services (EVS);
Performance characterization
(3GPP TR 26.952 version 13.0.0 Release 13)**



Reference

RTR/TSGS-0426952vd00

Keywords

LTE,UMTS

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status.
Information on the current status of this and other ETSI documents is available at
<http://portal.etsi.org/tb/status/status.asp>

If you find errors in the present document, please send your comment to one of the following services:
<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2016.
All rights reserved.

DECT™, PLUGTESTS™, UMTS™ and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.
3GPP™ and **LTE™** are Trade Marks of ETSI registered for the benefit of its Members and
of the 3GPP Organizational Partners.
GSM® and the GSM logo are Trade Marks registered and owned by the GSM Association.

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Report (TR) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under
<http://webapp.etsi.org/key/queryform.asp>.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Intellectual Property Rights	2
Foreword.....	2
Modal verbs terminology.....	2
Foreword.....	6
1 Scope	7
2 References	7
3 Abbreviations	8
4 General	9
4.1 Project History.....	9
4.2 Overview of the EVS Codec Work Item	10
4.3 Presentation of the Following clauses	11
5 Terms of Reference	11
6 Selection Process.....	12
7 Introduction to the Testing of the EVS codec	13
7.0 General methodology	13
7.1 EVS Selection Phase Testing	13
7.2 EVS Characterization Phase Testing	16
8 Important Notes about the Interpretation of Test Results	16
9 EVS Performance in Narrowband	17
9.1 NB Selection Tests	17
9.1.1 Experiment N1.....	18
9.1.2 Experiment N2.....	19
9.1.3 Experiment N3.....	21
9.1.4 Experiment N4.....	21
9.2 NB Characterization Tests.....	23
9.2.0 List of experiments in the narrowband telephone bandwidth	23
9.2.1 Experiment N1.....	23
9.2.2 Experiment N2.....	25
9.2.3 Experiment N3.....	25
9.2.4 Experiment N4.....	27
9.3 Conclusions on EVS Performance in Narrowband	28
10 EVS Performance in Wideband	28
10.1 WB Selection Tests	28
10.1.1 Experiment W1.....	29
10.1.2 Experiment W2.....	30
10.1.3 Experiment W3.....	31
10.1.4 Experiment W4.....	31
10.1.5 Experiment W5.....	32
10.1.6 Experiment W6.....	32
10.1.7 Experiment W7.....	33
10.1.8 Experiment I1	34
10.1.9 Experiment I2	34
10.1.10 Experiment I3	35
10.1.11 Experiment I4	36
10.1.12 Experiment I5	36
10.1.13 Experiment I6	37
10.2 WB Characterization Tests.....	38
10.2.0 List of experiments in the wideband frequency bandwidth	38
10.2.1 Experiment W1	38

10.2.2	Experiment W2	39
10.2.3	Experiment W3	41
10.2.4	Experiment W4	43
10.2.5	Experiment W5	44
10.3	Conclusions on EVS Performance in Wideband	46
11	EVS Performance in Super-Wideband	47
11.1	SWB Selection Tests	47
11.1.1	Experiment S1	47
11.1.2	Experiment S2	48
11.1.3	Experiment S3	49
11.1.4	Experiment S4	50
11.1.5	Experiment S5	51
11.1.6	Experiment S6	52
11.1.7	Experiment S7	53
11.2	SWB Characterization Tests	54
11.2.0	List of experiments in the super-wideband frequency bandwidth	54
11.2.1	Experiment S1	55
11.2.2	Experiment S2	55
11.2.3	Experiment S3	57
11.2.4	Experiment S1_Noisy	58
11.3	Conclusions on EVS Performance in Super-Wideband	59
12	Mixed Bandwidth and Fullband Tests in Characterization	59
12.1	Mixed Bandwidth Tests	59
12.1.1	Experiment M1	60
12.1.2	Experiment M2	61
12.1.3	Experiment M3	62
12.2	Fullband Tests	64
12.2.0	List of experiments in the fullband frequency bandwidth	64
12.2.1	Experiment F1	64
12.2.2	Experiment F2	65
13	Objective Evaluations	66
13.1	Selection Phase	66
13.1.1	Objective Measurements	66
13.1.2	Verification of Codec Performance with respect to Acoustic Test Cases based on the EVS Selection Phase Executable	67
13.1.2.1	Evaluation Setup	67
13.1.2.2	General	68
13.1.2.3	EVS-Mode: Narrowband (NB) -- Frequency Response with Real Speech	69
13.1.2.4	EVS-Mode: Wideband (WB) – Frequency Response with Real Speech	69
13.1.2.5	EVS-Mode: Super-Wideband (SWB) – Frequency Response with Real Speech	70
13.1.2.6	Conclusions	71
13.2	Complexity and Delay Analysis	71
13.3	EVS JBM Objective Performance Evaluation in Channel Aware Mode	73
13.4	Frequency Response	75
13.4.1	Evaluation of Codec Performance with respect to Acoustic Test Cases based on EVS v.12.1.0 [7]	75
13.4.1.1	Evaluation Setup	75
13.4.1.2	General	75
13.4.1.3	EVS-Mode: Narrowband (NB) – Frequency Response with Real Speech	76
13.4.1.4	EVS-Mode: Wideband (WB) – Frequency Response with Real Speech	77
13.4.1.5	EVS-Mode: Super-Wideband (SWB) – Frequency Response with Real Speech	78
13.4.1.6	EVS-Mode: Fullband (FB) – Frequency Response with Real Speech	79
13.4.1.7	Conclusions	80
13.5	Further Evaluations	80
13.6	Conclusions on Objective Evaluations	80
Annex A:	ToR Tests in Selection Phase	81
A.1	ToR Tests for Requirements	81
A.2	ToR Tests for Objectives	84

A.3	ToR Tests by Sets.....	85
A.4	Comparison of Listening Labs	86
Annex B:	Overall Characterization of the EVS Codec.....	88
Annex C:	EVS Permanent Documents in 3GPP FTP-site.....	89
Annex D:	Attachments.....	90
Annex E:	Change History	91
	History	92

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document provides information on the Enhanced Voice Services (EVS) codec Selection, Verification and Characterization Phases which were run using the fixed-point code (3GPP TS 26.442). Experimental test results from the subjective quality testing are reported to illustrate the behaviour of the EVS codec. Additional information is provided on implementation complexity of the EVS codec and objective test results. Also the verification results for the floating-point version of the EVS codec (3GPP TS 26.443) are presented.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 26.441: "Codec for Enhanced Voice Services (EVS); General overview".
- [3] 3GPP TS 26.442: "Codec for Enhanced Voice Services (EVS); ANSI C code (fixed-point)".
- [4] 3GPP TS 26.443: "Codec for Enhanced Voice Services (EVS); ANSI C code (floating-point)".
- [5] 3GPP TS 26.444: "Codec for Enhanced Voice Services (EVS); Test Sequences".
- [6] 3GPP TS 26.445: "Codec for Enhanced Voice Services (EVS); Detailed algorithmic description".
- [7] 3GPP TS 26.446: "Codec for Enhanced Voice Services (EVS); Adaptive Multi-Rate - Wideband (AMR-WB) backward compatible functions".
- [8] 3GPP TS 26.447: "Codec for Enhanced Voice Services (EVS); Error concealment of lost packets".
- [9] 3GPP TS 26.448: "Codec for Enhanced Voice Services (EVS); Jitter buffer management".
- [10] 3GPP TS 26.449: "Codec for Enhanced Voice Services (EVS); Comfort Noise Generation (CNG) aspects".
- [11] 3GPP TS 26.450: "Codec for Enhanced Voice Services (EVS); Discontinuous Transmission (DTX)".
- [12] 3GPP TS 26.451: "Codec for Enhanced Voice Services (EVS); Voice Activity Detection (VAD)".
- [13] 3GPP TS 26.114: "IP Multimedia Subsystem (IMS); Multimedia telephony; Media handling and interaction".
- [14] 3GPP TS 26.131: "Terminal acoustic characteristics for telephony; Requirements".
- [15] 3GPP SP-100202: "EVS Work Item Description".
- [16] 3GPP TR 22.813: "Study of use cases and requirements for enhanced voice codecs for the Evolved Packet System (EPS) ".
- [17] EVS-3 Permanent Document: "EVS Performance Requirements".
- [18] EVS-4 Permanent Document: "EVS Design Constraints".