ETSI TR 126 969 V14.0.0 (2017-04)

Digital cellular telecommunications system (Phase 2+) (GSM);
Universal Mobile Telecommunications System (UMTS);
eCall data transfer;
In-band modem solution;
Characterization report
(3GPP TR 26.969 version 14.0.0 Release 14)

3GPP A GLOBAL INITIATIVE
GSM® GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS

Reference
RTR/TSGS-0426969ve00

Keywords
GSM,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

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 "**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 5
Introduction 5
1 Scope 6
2 References 6
3 Definitions and abbreviations 7
3.1 Definitions 7
3.2 Abbreviations 8
4 Selection tests 9
4.0 General 9
4.1 Performance objectives and requirements 9
4.1.1 Test procedures 10
4.1.2 Test results 11
4.2 Design constraints 12
4.2.1 Test procedures 12
4.2.2 Test results 12
5 Verification and characterization tests 13
5.1 Performance with dynamic jitter buffer 13
5.2 Performance with echo cancellation 16
5.3 Performance with transcoding 16
5.3.1 Performance with ITU-T G.711&G.726 transcoding 18
5.3.2 Performance with ITU-T G.729 A/B transcoding 18
5.4 Performance with packet loss concealment techniques 18
5.5 Performance with other codec types 21
5.5.1 GSM HR 21
5.5.2 GSM EFR 21
5.5.3 HR AMR 23
5.5.4 AMR-WB 24
5.6 Performance with additional channel conditions 26
5.6.1 Different C/I 26
5.6.2 AGC variations 27
5.7 Varying channel conditions 28
5.7.1 Description of test setup 28
5.7.2 Test results 28
5.8 Performance with static jitter buffer 29
5.8.1 Simulation Methodology 31
5.8.2 Jitter buffer with ITU-T G.711 A-law speech frames 32
5.8.3 Jitter buffer with ITU-T G.729 speech frames 32
5.9 Noisy conditions 32
5.10 Erroneous tone detection 34
5.11 Gaps in transmission due to handovers 34
5.12 Change of speech codec 36
5.12.1 Change of AMR codec modes 36
5.12.2 Change of speech codec in handover 37
5.13 Sample slip / small delay variations at handover 38
5.14 Combinations of test conditions 38
5.14.1 GSM HR and HR AMR with transcoding (G.729 / G.726) under different channel conditions 38
5.14.2 CSoHS with transcoding (G.729a / G.711) and echo cancellation 39
Annex A: eCall test setup 40
A.1.1 Measurement of the MSD transmission time 42

Annex B: Required transmission times for IVS initiated eCall signalling and HL-ACK 45

Annex C: Extended simulation results 46

C.1 Dynamic jitter buffer 46

C.2 Transcoding 52

C.3 Sample slip 55

C.4 CSoHS with transcoding (G.729a / G.711) and echo cancellation 61

Annex D: Additional Performance Indicators 66

Annex E: Change history 75

History 76

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.

Introduction

eCall refers to an interoperable in-vehicle emergency call service which is envisioned to be introduced and operated across Europe in 2014. According to reports from the European Commission, it is foreseen that eCall will be offered on all new vehicles in the EU by 2014.

The European Commission has brought together standardization bodies, the automotive industry, mobile telecommunication industry, public emergency authorities and others in the eSafety Forum initiative which has identified high-level requirements, recommendations and guidelines for this eCall service [2] and [3]. The eSafety Forum has assigned ETSI MSG to standardize those parts of the eCall service that affect the mobile communication system. The development of the eCall standard has been further delegated to the 3rd Generation Partnership Project (3GPP).

1 Scope

The present document characterizes the performance of the eCall In-band Modem, which is used for reliable transmission of the eCall Minimum Set of Data (MSD) from an In-Vehicle System (IVS) to the Public Safety Answering Point (PSAP) via the voice channel of cellular and PSTN networks.

The European Union eCall requirements, recommendations and guidelines were developed by eSafety Forum [3] and [4], with important additional work produced by ETSI MSG, GSME, 3GPP, and CEN.

Previous work in 3GPP TR 22.967 [5] "Transfer of Emergency Call Data", examined the issues associated with the transmission of emergency call data from a vehicle to a PSAP. This analysis identified that the preferred option be based on an in-band modem solution.

eCall provides reliable full-duplex data communications between IVS and PSAP in addition to emergency voice call (E112) via the cellular network, and can be initiated either automatically or manually [6]. The eCall In-band Modem uses the same voice channel as used for the emergency voice call. eCall allows reliable transmission of MSD alternating with a speech conversation through the existing voice communication paths in cellular mobile phone systems. The expected benefit is that emergency services will be made aware of accidents much more rapidly, will get precise information on location, vehicle type etc. and therefore will be able to reach accident victims faster, with the potential to save many lives annually.

The eCall in-band modems (IVS and PSAP) are fully specified by the ‘General description ‘ TS 26.267 [9] together with the C-code reference as provided in 3GPP TS 26.268 [7]. 3GPP TS 26.269 [8] deals with the conformance testing for eCall modem implementations.

The present document provides a detailed performance characterization of the eCall in-band modem solution. Results from the 3GPP selection tests as well as verification and characterization tests have been collected into this report. It is impossible to test the eCall modem for all conditions that might arise on the transmission path from the IVS to the PSAP. However, the selected set of test scenarios represents a wide range of conditions that are foreseen to potentially occur in the in-band transmission of eCall data over the radio access and core networks as well as the PSTN.

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] eSafety Forum eCall Driving Group: "European Memorandum of Understanding for Realisation of Interoperable In-Vehicle eCall", May 2004.

[3] eSafety Forum: "Clarification Paper – EG.2 , High level requirements for a eCall in-vehicle system, Supplier perspective", March 2006, Version 1.0.

[4] eSafety Forum: "Recommendations of the DG eCall for the introduction of the pan-European eCall", April 2006, Version 2.0.

[5] 3GPP TR 22.967: "Transferring of Emergency Call Data".

[6] 3GPP TS 22.101: "Service aspects; Service principles".

[7] 3GPP TS 26.268: "eCall Data transfer; In-band modem solution; ANSI-C reference code".