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Technical Report

Terrestrial Trunked Radio (TETRA);
User Requirement Specification TETRA Release 2;
Part 3: Codec

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Contents

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Foreword

This Technical Report (TR) has been produced by ETSI Project Terrestrial Trunked Radio (TETRA).

The present document is part 3 of a multi-part deliverable covering the User Requirement Specifications (URSs) for TETRA Release 2, as identified below:

Part 1: "General Overview";

Part 2: "High Speed Data";

Part 3: "Codec";

Part 4: "Air Interface Enhancements";

Part 5: "Interworking and Roaming";

Part 6: "Subscriber Identity Module (SIM)";

Part 7: "Security".

Introduction

The TETRA Release 2 suite of standards was mandated in the new Terms of Reference (ToR) for ETSI Project TETRA approved at ETSI Board meeting number 28 (Board 28) on 6th September 2000 [7][8]. Its aim was to enhance the services and facilities of TETRA in order to meet the emerging user requirements, utilize new technologies and, by maintaining the competitiveness with other wireless technologies, increase the futureproofness of TETRA as the standard for PMR and PAMR worldwide.

The approved programme for TETRA Release 2 covers five work areas, namely:

- high speed data;
- speech coding;
- air interface enhancements;
- interworking and roaming;
- SIM

The present document provides the User Requirement Specification for Speech Coding.

The URS is required by Working Group 5 (WG5) of EPT for the new voice codec (or codecs).

1 Scope

The present document provides the user requirements for enhancement of Codec. The main requirements in such an enhancement are the following:

- improved end-to-end delay performance;

- voice quality improvement over the existing TETRA codec;

- equal or better immunity to background noise;

- interworking with GSM/UMTS (no double vocoding);

- interoperability with the existing TETRA codec;

The present document is applicable to the specification of TETRA Release 2 equipment.

The user requirements contained in this URS are described in non-technical terms and are based on an analysis of the results for the voice codec from the TETRA Release 2 Market Questionnaire (see bibliography), described in TR 102 021-1 [1], clauses 4.2 and 4.3.

2 References

For the purposes of this Technical Report, the following references apply:

[1] ETSI TR 102 021-1: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2; Part 1: General Overview".

[2] ETSI TR 102 021-2: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2; Part 2: High Speed Data".

[3] ETSI TR 102 021-4: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2; Part 4: Air Interface Enhancements".

[4] ETSI TR 102 021-5: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2; Part 5: Interworking and Roaming".

[5] ETSI TR 102 021-6: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2; Part 6: Subscriber Identity Module (SIM)".

[6] ETSI TR 102 021-7: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2; Part 7: Security".

[7] B28 (00)12: "Extension of EPT Terms of Reference to Enable TETRA 'Release 2'".

[8] B28 (00)24 Rev 2: "Summary minutes, decisions and actions from 28th ETSI Board Meeting, Sophia Antipolis, 5-6 September 2000".

3   Definitions and abbreviations

3.1   Definitions

For the purposes of the present document, the following terms and definitions apply:

TETRA Release 2: Work Programme with new terms of reference within ETSI Project TETRA to enhance the services and facilities of TETRA in order to meet new user requirements, utilize new technology and increase the longevity of TETRA within the traditional market domains of PMR and PAMR

interworking: where TETRA users on one system can communicate with mobile users on another system (which could be TETRA or different), as long as they operate within their home TETRA network, i.e. they cannot roam into another system

3.2   Abbreviations

For the purposes of the present document, the following abbreviations apply:

EPT	ETSI Project TETRA
ETSI	European Telecommunications Standards Institute
GSM	Global System for Mobile communications
NATO	North Atlantic Treaty Organization
PS	Public Safety
PAMR	Public Access Mobile Radio
PMR	Professional (or Private) Mobile Radio
TETRA	TErrestrial Trunked RAdio
UMTS	Universal Mobile Telecommunications System
URS	User Requirement Specification
WG	EPT Working Group

4   User Requirement Specification

4.1   Method of analysis

This URS has been defined using the feedback of users and possible users to the TETRA Release 2 Market Questionnaire (see bibliography). The individual responses from different user organizations have been weighted in accordance with the size of the TETRA system planned by the responder. The number of base stations and terminals obtained from user feedback form the basis to determine the user specific weighting factor. In order to compensate for the fact that the number of replies to the questionnaire is not evenly distributed over all market segments, a second, segment specific weighting factor, has been taken into account. The weighted results of the respondents have been grouped in segments in a way that commonalties could be analysed. So far users from the PS, PAMR and Defence segments have provided answers to the questionnaire. The requirement analysis considers both feature requirements and requested time scales for the availability of the new voice codec(s).

4.2   Need for new codec

The TETRA Release 1 voice codec has been found to be appropriate for PMR and PAMR voice communications. This is particularly the case in the PS sector where 90 % of the user responses indicate that a new codec is not required. However the move towards UMTS/3G and the large diffusion of TETRA in different market segments have created demands for additional features and performance figures. It is envisaged that these new requirements will lead to standardization of one or more new codecs for TETRA Release 2 networks. The major aim of these new codecs is to enhance the voice quality for TETRA and to allow efficient interworking with UMTS/3G networks.

The TETRA standard can support up to four voice codecs. This flexibility also means that new terminals could operate with the existing TETRA codec and additional new codec(s).

4.3   Relative importance of the TETRA 2 codec

Users were asked to assign a relative importance figure to all of the new features considered for standardization in TETRA Release 2. The weighted overall importance given to new codec(s), in relation to other features of TETRA Release 2, by users among all market segments is 10 % (see figure 1).
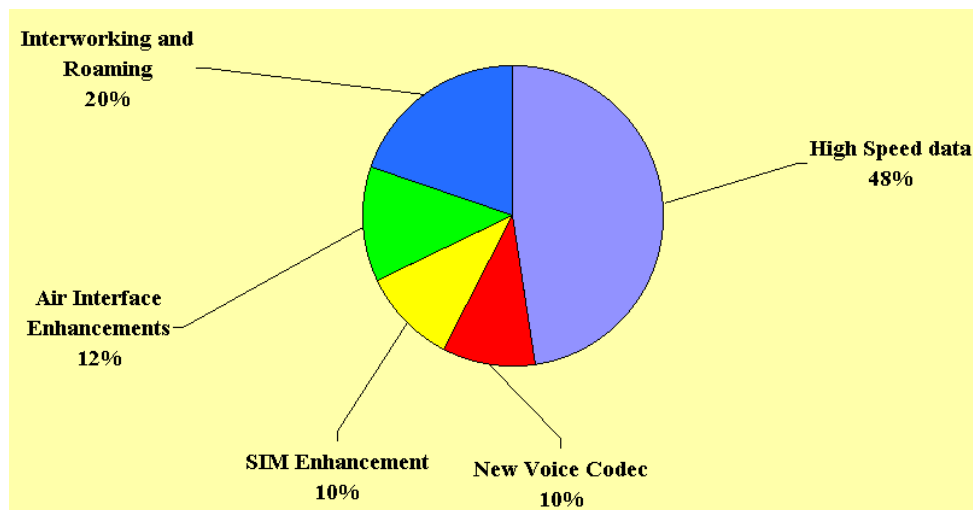

Figure 1: Weighted overall importance

In general we can conclude that the relative importance of the new codec is moderate.

4.4   Improved end-to-end delay performance

End-to-end delay is a key factor in the perceived quality of voice communication. Although the end-to-end delay of the TETRA 1 codec itself is considered to be adequate, some 23 % of weighted votes over all market segments do require an improvement in the overall end-to-end delay (see figure 2). This requirement is slightly more important for users in the Public Safety segment where 31 % of votes have been assigned (see figure 3).
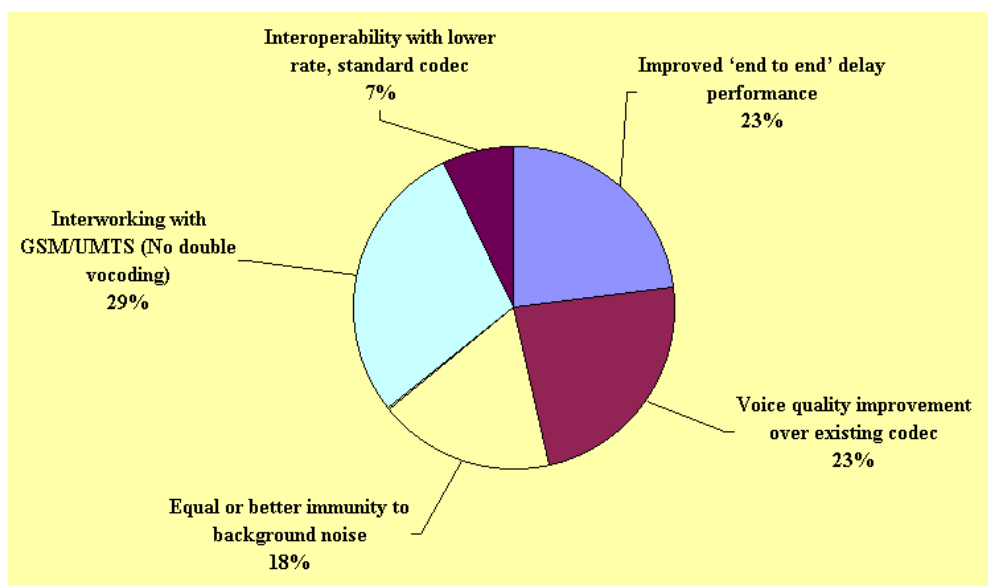

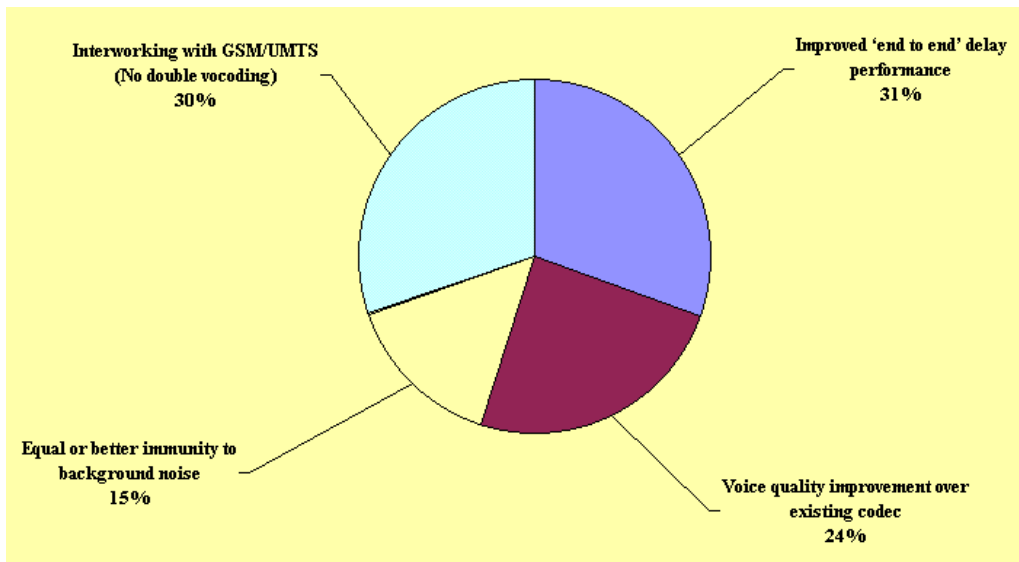**Figure 2: Weighted codec requirements (all market segments)**

Figure 3: Weighted codec requirements (Public Safety)

The end-to-end delay incurred by new codecs shall not exceed the delay performance of the TETRA 1 codec.

NOTE: The end-to-end voice delay performance over a TETRA network is a combination of several factors with the frame structure of TETRA being the most significant. For this reason, it is recommended that improved end-to-end delay shall be included as a user requirement in the TETRA 2 Air Interface Enhancement URS [3].

4.5   Codec specific performance figures

4.5.1   Fundamental requirements

The following three fundamental requirements are considered to be purely codec specific:

- voice quality improvement;

- immunity to background noise;

- interworking with GSM/UMTS.

Further to what has been said in clause 4.4, end-to-end delay has not been considered as one of the above codec specific performance requirements.

The relative importance of these three requirements can be seen from figures 4 and 5.
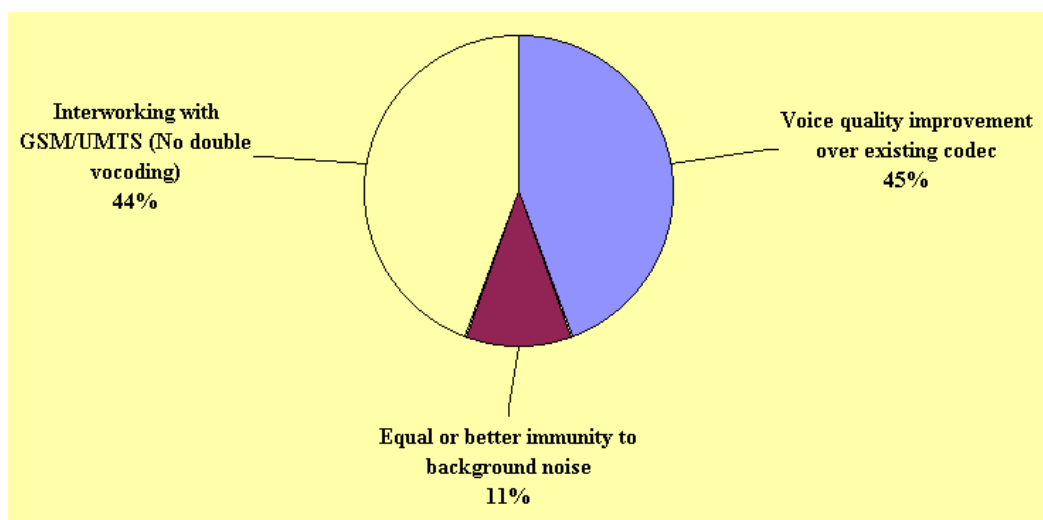
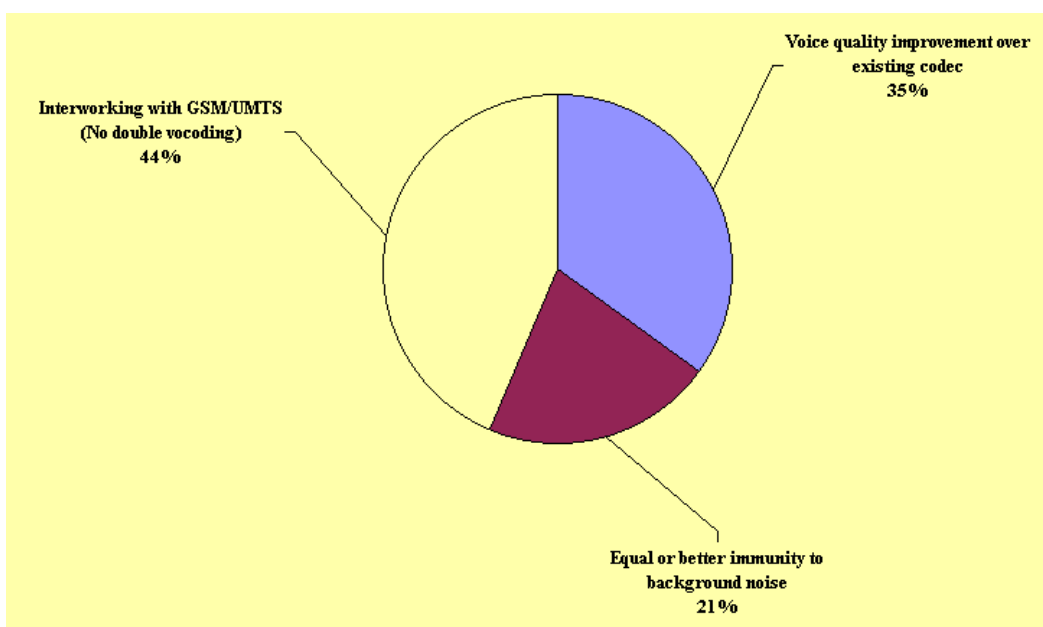**Figure 4: Weighted codec requirements excluding end-to-end delay (PAMR)**

Figure 5: Weighted codec requirements excluding end-to-end delay (Public Safety)

The result of the questionnaire responses to these three performance figures is given in the next clauses. It is worthwhile to note that the relative importance given by the users does not substantially differ amongst the various market segments.

4.5.2   Voice quality improvement over existing codec

It can be concluded from responses to Questionnaire that improved voice quality is considered **highly** important in all market segments, although it is considered more important by PAMR users than by PS users.

4.5.3   Equal or better immunity to background noise

Equal or better immunity to background noise with respect to the TETRA 1 codec is considered to be of **moderate** importance.

4.5.4   Interworking with GSM/UMTS (No double vocoding)

Direct interworking with GSM/UMTS networks, without double vocoding is considered to be of **high** importance.

4.6   Interoperability with lower rate, standard codec

The military segment that is considered a potential future user of TETRA technology has raised this requirement.

NATO is in the selection phase of a new codec for use in military environments. The deadline for this selection process is end-2001.The key-requirement of NATO is low bandwidth (e.g. 2,4/1,2 kbps). Concerning voice quality requirement, the primary objective is intelligibility in high-noise environments. It is believed that the codec that meets the requirements of TETRA users in non-military market segments does not satisfy the military requirements and vice versa. Therefore it is suggested to evaluate the feasibility of including the NATO codec candidate in the TETRA Release 2 standard, subject to its specification being available within the standardization timeframe.

4.7   Timescales for the new codec

Users have been asked in the Questionnaire about availability in time of the TETRA Release 2 codec(s). Responses are spread over a 5-year period. As a tentative interpretation of these results we conclude that this requirement is dependent on market sectors. The availability requirements from different segments are given in figure 6. It is evident that the PAMR users require the new TETRA Release 2 codecs by 2002 whilst the majority of PS users do not require such codecs before the 2005. As far as the military segment is concerned the user has given no indications and so this matter will be explored further.
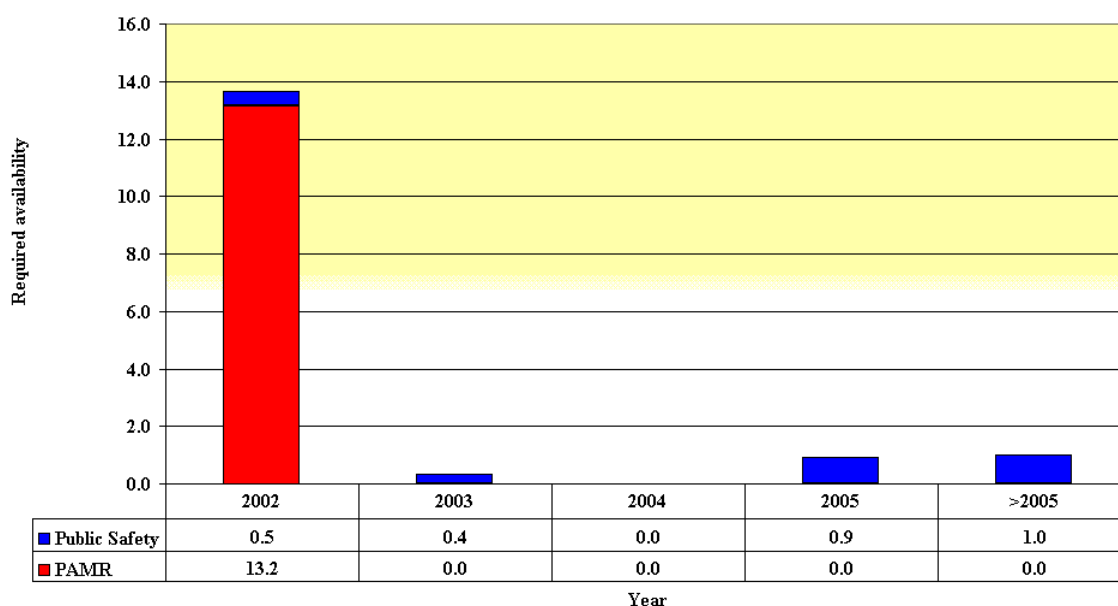

	2002	2003	2004	2005	>2005
■ Public Safety	0.5	0.4	0.0	0.9	1.0
■ PAMR	13.2	0.0	0.0	0.0	0.0

Figure 6: Weighted codec availability requirements

Annex A:
Bibliography

EPT/WG1(01)046v9: "ETSI Project TETRA (EPT) TETRA Release 2 Questionnaire"

EPT13(00)17r1: "TETRA Release 2 Work Programme"

History

Document history		
V1.1.1	December 2001	Publication