

Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2; Part 2: High Speed Data



Reference

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Foreword

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

The present document is part 2 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 [2], [3]. 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 future proofness 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

This Technical Report (TR) provides the User Requirement Specification for High Speed Data (HSD).

The URS is required by Working Group 4 (WG4) of EPT in response to the invitation contained in document WG1(00)72 (see bibliography).

1 Scope

The present document contains the User Requirements Specifications (URS) which are described in non-technical terms and are based on an analysis of the results for High Speed Data from the TETRA Release 2 Market Questionnaire (see bibliography), described in TR 102 021-1 [1], clauses 4.2 and 4.3 and subsequent results from a joint ETSI/TETRA MoU High Speed Data Workshop held in January 2002 (see bibliography). This URS does not offer any technical solutions as they are considered the responsibility of EPT/WG4. The present document provides the user requirements for HSD translated into terms of:

- HSD applications and net data rates to support non-voice applications
- Data rate capacity in addition to TETRA V+D
- RF coverage requirements for HSD
- Frequency spectrum efficiency requirements
- Integration of HSD with TETRA Release 1 V+D services
- Compatibility of HSD with TETRA Release 1 V+D services
- HSD call types
- Backward Compatibility with TETRA Release 1
- Migration from TETRA Release 1
- Availability of HSD
- Relative importance of HSD user requirement criteria

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

2 References

For the purposes of this Technical Report (TR), 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] B28(00)12: "Extension of EPT Terms of Reference to Enable TETRA "Release 2".
- [3] 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 (see bibliography) 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

High Speed Data: net data rates in excess of 28,8 kbit/s being the current capability of TETRA Release 1

3.2 Abbreviations

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

GoS	Grade of Service
HSD	High Speed Data
kbit/s	kilo (thousand) bits per second
MoU	Memorandum of Understanding
MS	Mobile Station
PAMR	Public Access Mobile Radio
PMR	Private Mobile Radio
RF	Radio Frequency
SwMI	Switching Management Infrastructure
TIP	TETRA Interoperability Profile
ToR	Terms of Reference
URS	User Requirement Specification
V+D	Voice and Data
VoIP	Voice over Internet Protocol
WAP	Wireless Application Protocol

4 User Requirement Specification

4.1 HSD technology solution

The HSD technology solution selected by WG4 will be based on a technology that best meets the User Requirements as described in this URS, balanced against any technology constraints identified in WG4 from the candidate technology proposals submitted into WG4 for HSD standard consideration.

4.2 HSD applications and net data rates to support non-voice applications

The net data rates to support non-voice applications on HSD are listed in table 1. For ease of understanding requirements, the table has been sorted in order of net data rates. It is important to note that these HSD applications were derived solely from EPT/WG1(00)59 (see bibliography) and from results from a joint ETSI/TETRA MoU High Speed Data Workshop held in January 2002 (see bibliography) and did not take into consideration the needs of other TETRA and PMR users organizations who did not participate in the questionnaire or workshop.

Table 1: Net data rates to support non-voice applications

Applications	2005 Voice % impact	kBytes	kbits	Transfer time (seconds)	kbit/s (Net)	Application group
Location Services	-2 %	0,1	0,8	1	0,8	Real time short data
Telemetry (real time transfer)	0 %	0,2	1,6	0,5	3,2	Real time short data
Operation and control	0 %	0,2	1,6	0,5	3,2	Real time short data
Biodynamic vital data sampling, inc. ECG	0 %	5	40	10	4	Real time short data
Telemetry (Real time - 5 kbyte)	0 %	5	40	10	4	Real time short data
WAP/on-line forms	0 %	3	24	5	4,8	Database Interaction
People & Vehicles status/location/messaging(1 kbyte-)	-2 %	1	8	1	8	Real time short data
Data tasking e.g. command and control/work management	-5 %	5	40	5	8	Database Interaction

Applications	2005 Voice % impact	kBytes	kbits	Transfer time (seconds)	kbit/s (Net)	Application group
Fingerprint data abstracted from the fingerprint image	0 %	10	80	10	8	File transfer
Content Push (10 kbyte)	1 %	10	80	4	20	File Transfer
Interagency Communications inc. Intranet (10 kbyte)	0 %	10	80	4	20	File Transfer/Office Application
Database inquiries 10 kbyte to 100 kbyte	0 %	12.5	100	5	20	Database Interaction
Mobile computing - office applications	0 %	12.5	100	5	20	Office Application
Connect to hospitals and national health comm. network	0 %	100	800	20	40	File Transfer
Connect to hospitals and national health comm. network	1 %	50	400	10	40	Office Application
Internet incl. web browsing 10 kbyte to 50 kbyte (per page)	0 %	50	400	10	40	Office Application
Video streaming (surveillance)	0 %			delay a few seconds	50	Video Transfer
Graphics, maps, location 100 kbyte to 1Mbyte	-1 %	125	1 000	20	50	Image Transfer
e-mails incl. Attachments 2 Mbytes	0 %	2 000	16 000	300	53	File Transfer
Video Conferencing 64 kbit/s	0 %				64	Video Transfer
Image transfer (image JPEG \pm 50 kbyte)	0 %	100	800	10	80	Image Transfer
Fingerprint image	0 %	100	800	10	80	Image Transfer,
Video clips 1 Mbytes to 2 Mbytes	0 %	2 000	16 000	32	500	Video Transfer

From the table it can be seen that a significant percentage of applications can be supported with net data rates of 80 kbit/s and below. Some as yet undefined applications may require higher data rates. Higher data rates may also be required to improve transfer time of applications identified above. Many of the listed applications could also be supported on a V+D network.

Although the information provided on this table is useful, it is important to note that the mix of applications supported on a network and the amount of non voice traffic is unknown.

It is also important to note that the applications listed could be rationalized further within categories. However, as the GoS requirements (transfer time in seconds as shown in the table) vary between the identical applications, their individuality has been retained.

4.3 Data rate capacity in addition to TETRA V+D

Analysis of the non-voice application requirements listed in table 1 has identified that the new HSD service will have very little impact in reducing voice traffic levels in TETRA networks. For this reason, the provision of HSD on existing networks will require separate capacity to support non-voice applications dependent on type of applications, levels of traffic and GoS.

Based on past experience, the types of non-voice applications, traffic levels and GoS will vary greatly between different user organizations. As a result, some organizations will have a low demand for HSD services and others a high demand.

For these reasons, the HSD technology solution should be designed to support varying amounts of data as spectrum efficient as possible balanced against technology constraints. In addition, the HSD solution should be such as to minimize impact on network RF planning and compatibility with TETRA Release 1 networks already deployed and/or being deployed.

4.4 RF coverage requirements for HSD

Ideally, the RF coverage characteristics of HSD should match that of TETRA Release 1 for Voice and Data. Analysis of user requirements of RF coverage needs for HSD applications vary greatly between different user organizations. For example, some users want total RF coverage, others would trade off data rate as distance increases from the base station and others would be satisfied with only urban (high population density) coverage.

Based on these user requirements, the HSD technology solution adopted should consider a mechanism for meeting these varying needs.

4.5 Frequency spectrum efficiency requirements

As mentioned in clause 4.3, analysis of non-voice applications identified that the new HSD service will have very little impact in reducing voice traffic levels in TETRA networks. For this reason, if the Grade of Service for voice services is to remain unchanged, the provision of HSD on existing networks will require additional frequency spectrum to support non-voice applications dependent on type of applications, levels of traffic and GoS. Alternatively, HSD services may be introduced by reducing the Grade of Service of existing voice services and hence freeing network capacity to maximize user benefits within existing network resources. This will not be acceptable to all users.

Also, as mentioned in clause 4.3, the demand for non-voice applications will vary greatly between different user organizations. For these reasons, the HSD service should utilize the minimum amount of RF spectrum required to meet the non-voice application, capacity and GoS needs of individual user organizations.

In addition, there is a need to retain the narrow band characteristics of TETRA for co-existence with other TETRA V+D networks and other narrow band technologies sharing the same frequency bands.

For the reasons above, the HSD technology solution should consider a design that provides flexibility to meet these requirements.

4.6 Integration of HSD with TETRA Release 1 V+D services

The user requirements for HSD services are marked by a strong need for integration with the V+D services of TETRA Release 1. The degree of integration varies from very high for simultaneous Voice and HSD operation, to moderate and low respectively for voice communication priority over HSD to independent operation of Voice and HSD. These respective user integration requirements for all markets combined are listed in table 2.

Table 2: User integration requirements

Integration criteria	Importance (Percentage)	Respondent (Min/Max)
Simultaneous HSD and V+D operation	55	0/100
Non-Simultaneous HSD with V+D service priority	34	0/100
Non-Simultaneous HSD and V+D operation	10	0/50

As well as the importance weighting for each criteria, a column showing the Minimum (Min) and Maximum (Max) weighting from the respondents is provided.

As these integration requirements will vary between user organizations, the implementation of HSD should be such as to support all three requirements.

NOTE: It is expected that the extent of service interaction requirements will be considered by ongoing work within WG1. For example further work may be required to confirm that simultaneous voice and HSD within TETRA Release 2 should have the same meaning as simultaneous Voice and Data within TETRA Release 1.

4.7 Compatibility of HSD with TETRA Release 1 V+D services

Although outside the scope of the TETRA Release 2 Questionnaire, it has been requested by WG4 to consider the following three aspects as part of the HSD URS where HSD needs to be compatible with TETRA Release 1 as near as practically possible. These three areas are:

- VoIP
- Network data interface
- Speed of MS unit

Although the internal aspects of a SwMI are not in the scope of any TETRA standard (except for external interfaces), consideration should be given in the HSD technology solution as to the impact to VoIP networks in terms of GoS and data capacity provision within the SwMI.

With regard to network data interfaces, consideration should be given in the HSD technology solution as to the variety of interfaces that would need to be supported for HSD.

With regard to the velocity of MS units, it is important that the HSD technology solution should not greatly differ in performance than that already offered in TETRA Release 1.

In addition to the above, it is important that the HSD technology solution should not degrade the performance of any TETRA Release 1 network and shall be compliant with the TETRA Release 1 standard and TETRA Interoperability Profiles (TIPs) where applicable.

4.8 HSD call types

The user requirement for HSD call types has many variants within the "one to one" and "one to many" categories. The communications matrix in table 3 shows the variety of call types required for HSD.

Table 3: HSD call type communications matrix

One to one (Call Initiator)	MS	Dispatcher	Data network
MS	Yes	Yes	Yes
Dispatcher	Yes	Yes	Yes (see note)
Data network	Yes	Yes (see note)	N/A
One to many (Call Initiator)			
MS	Yes	Yes	Yes
Dispatcher	Yes	Yes	Yes (see note)
Data network	Yes	Yes (see note)	N/A
NOTE: Although this call is valid, it is not related to the HSD air interface.			

Based on this requirement, the HSD technology solution should support both "one to one" and "one to many" call types from both MS and fixed users within a TETRA network and from user operating in externally connected networks.

4.9 Backward compatibility with TETRA Release 1

For reasons of evolution and utilization of TETRA Release 1 services, a TETRA Release 2 network provisioned with HSD must support TETRA Release 1 terminals while not causing any degradation of services, facilities and operational performance to TETRA Release 2 terminals on the network.

Likewise a TETRA Release 1 network must support TETRA Release 2 terminals provisioned with HSD while not causing any degradation of services, facilities and operational performance to TETRA Release 1 terminals on the network.

Table 4 is provided to further explain these user requirements.

Table 4: Backward compatibility

Terminal type	TETRA R1 network	TETRA R2 network
V+D Terminal	Yes	Yes (see note 1)
V+D & HSD Terminal	Yes (see note 2)	Yes
HSD Terminal only	No (see note 3)	Yes (see note 3)
NOTE 1: As per Release 1 services and facilities supported on network.		
NOTE 2: May be provisioned on network before upgrade and therefore HSD operation must not effect Release 1 performance.		
NOTE 3: HSD operation must not effect Release 1 performance for other terminals on the network.		

4.10 Migration from TETRA Release 1

User organizations have expressed a need to utilize HSD services as economically as possible on existing TETRA V+D networks. For this reason, the implementation of HSD should be as economical as possible.

In addition, the field upgrade and provision of HSD on TETRA V+D networks should be carried out with the minimum of disruption to existing communication services.

4.11 Availability of HSD

From the user requirement's analysis a number of respondents see a market for HSD in 2005 onwards, with a similar number requiring a service before 2005. There is a section of the market that sees a need for HSD as early as 2002. Table 5 shows the respondent breakdown for HSD availability to support this requirement.

Table 5: Availability

Year of availability	Respondent indication
2002	2
2003	1
2004	1
2005	1
>2005	4

In order to understand how these different market needs may be accommodated more work is needed by WG1 to identify if an evolutionary approach to implementation can be specified, in view of potentially competing technologies such as UMTS/3G.

Recognizing the importance of standard evolution to support HSD services, the total requirement for the complete HSD suite of standards should be well understood to ensure that possible early implementation of basic HSD services do not impact future standard development work.

4.12 Relative importance of HSD user requirement criteria

As part of the TETRA Release 2 Questionnaire, respondents were requested to indicate the relative importance of criteria relating to HSD. The results of this question are listed in table 6.

Table 6: Criteria importance

HSD criteria	Importance (Percentage)	Respondent (Min/Max)
Compatibility with TETRA Release 1 V+D	40	0/100
Field upgrade capability with minimal disruption	24	0/90
Minimal need for new base station sites	21	0/80
Minimal need for new frequency spectrum	15	0/50

NOTE: Although this "relative importance weighting" is useful as a selection criteria for the HSD technology solution, there are other non-user requirement criteria that also needs to be considered. For example:

Co-existence with other TETRA networks and analogue and digital technologies sharing the same frequency band:

- Regulatory (CEPT and National Administrations).
- Manufacturer needs for maximum re-use of existing TETRA technology.

It is also important to note that the number of respondents to the TETRA Release questionnaire was relatively small reflecting only a small number of large Public Safety and PAMR TETRA user organizations, and/or potential TETRA user organizations in Western Europe. Although the investment in TETRA by these user organizations is estimated to represent over 70 % of the TETRA market in Western Europe, it is recognized that TETRA is being deployed in other regions of the world in a number of market segments outside Public Safety and PAMR. For this reason, a further review of user requirements may be necessary in order to provide an 'overall importance weighting' for user requirements which should be used as part of the HSD technology selection within WG4.

Annex A: Bibliography

- ETSI TR 102 021-3: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2; Part 3: Codec".
- ETSI TR 102 021-4: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2; Part 4: Air Interface Enhancements".
- ETSI TR 102 021-5: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2; Part 5: Interworking and Roaming".
- ETSI TR 102 021-6: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2; Part 6: Subscriber Identity Module (SIM)".
- ETSI TR 102 021-7: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2; Part 7: Security".
- EPT/WG1(00)72: "Invitation to WG1 to active participate in WG4 High Speed Packet Data (HSD)".
- EPT/WG1(01)046v9: "ETSI Project TETRA (EPT) TETRA Release 2 Questionnaire".
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- EPT/WG1(01)59r3: "Interim Report for High Speed Data Requirements based on TETRA Release 2 Questionnaire Analysis".
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History

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