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Contents

Foreword	5
Introduction	5
1 Scope	7
2 References	7
3 Definitions and abbreviations	7
4 Actors and roles in the provision and use of UMTS telecommunications services	8
4.1 Overview of the UMTS Role Model	8
4.2 Relationships in the provision and use of UMTS services	9
4.3 Description of Roles	9
5 System requirements	10
5.1 General	10
5.2 Migration towards UMTS	12
5.2.1 Introduction	12
5.2.2 Infrastructure Investment	12
5.2.3 Technology and developments in the regulatory environment	13
5.2.4 New Services	14
5.3 Environment	14
5.3.1 Service perspective	14
5.3.2 Operational perspective	16
5.4 Mobility	16
5.5 Terminals	16
5.5.1 Terminal types	16
5.5.2 Interfaces	17
5.5.3 Services	18
5.6 Services	18
5.7 Interworking	19
5.8 Numbering	19
5.9 Management	20
5.10 Billing	21
5.11 Security	21
Annex A (Informative): 1st and 2nd Generation systems	22
Annex B (Informative): Mapping of user needs to radio operating environments	23
Annex C (Informative): UMTS terminal capabilities:	25
History	26

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Foreword

This ETSI Technical Report (ETR) has been produced by the Special Mobile Group (SMG) Sub-Technical Committee (STC) of the European Standards Institute (ETSI). This ETR defines the system requirements for the Universal Mobile Telecommunications System (UMTS).

This ETR is an informative document resulting from ETSI STC-SMG5 studies, presenting requirements derived from the general objectives of UMTS [1].

Introduction

UMTS intends to provide services currently provided by diverse systems such as domestic cordless, public cellular, private mobile radio etc., and to provide an integrated service via infrastructure which may incorporate satellite and/or terrestrial components. UMTS aims to support a mass market, to provide speech quality similar to fixed networks, to provide services which demand higher performance requirements than can be provided by current mobile systems and to provide global roaming.

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1 Scope

This ETSI Technical Report (ETR) specifies the high level system requirements which are to be met by UMTS. These requirements apply across multiple technical areas (i.e. radio, services, security, network) take specific account of issues which impact upon the realisation of UMTS (i.e. commercial, regulatory, political issues). These requirements are derived from the objectives given in ETR 271 [1].

The implications and further elaboration of the system requirements with respect to technical matters will be addressed in separate ETRs and ETSSs, as outlined in the work programme for the standardisation of UMTS [2].

2 References

This ETR incorporates by dated and undated reference, provisions from other publications. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETR only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

- [1] ETR 271 (UMTS 01.01): "Special Mobile Group (SMG); Universal Mobile Telecommunications System (UMTS) objectives and system overview".
- [2] TCR-TR 015 (UMTS 00.01): "Special Mobile Group (SMG); Work programme for the standardisation of the Universal Mobile Telecommunications System (UMTS)".
- [3] DTR/SMG-050102U (UMTS 01.02): "Special Mobile Group (SMG); Vocabulary for the Universal Mobile Telecommunications System (UMTS)".
- [4] DTR/SMG-050901U (UMTS 09.01): "Special Mobile Group (SMG); Security principles for the Universal Mobile Telecommunications System (UMTS)".
- [5] DTR/SMG-050401U (UMTS 04.01): "Overall requirements on the radio interface(s) of the Universal Mobile Telecommunications System (UMTS)".
- [6] DTR/SMG-050501U (UMTS 05.01): "Universal Mobile Telecommunications System (UMTS); Objectives and framework for the Telecommunications Management Network (TMN)".
- [7] DTR/SMG-050601U (UMTS 06.01): "Quality requirements for speech and associated channel coding for the Universal Mobile Telecommunications System (UMTS)".
- [8] DTR/SMG-050201U (UMTS 02.01): "Framework for services to be supported by the Universal Mobile Telecommunications System (UMTS)".
- [9] DTR/SMG-050301U (UMTS 03.01): "Framework of network requirements, interworking and integration for the Universal Mobile Telecommunications System (UMTS)".
- [10] DTR/SMG-050901U (UMTS 09.01): "Security principles for the Universal Mobile Telecommunications System (UMTS)".
- [11] UMTS Task Force Report (Brussels 1st March 1996): "The Road to UMTS - in contact anytime, anywhere, with any one".

3 Definitions and abbreviations

UMTS network: any network conforming to the UMTS standard

Further definitions and abbreviations can be found in the Vocabulary for the Universal Mobile Telecommunications System (UMTS) [3].

4 Actors and roles in the provision and use of UMTS telecommunications services

In the context of provision and use of UMTS telecommunication services, various actors (persons, legal entities, or machines as their delegates) are involved within various relationships. In order to categorize the actions and responsibilities of an actor within a relationship, the concept of role is introduced.

A role may be defined as an attribute of an actor when considering it within a relationship with another actor, which also plays a role; it is a description of the actions and responsibilities of an actor in the relationship.

The objective of this section is to introduce the UMTS role model, the purpose of which is to :

- identify the actors involved in UMTS service provision and use;
- identify the relationships between these actors, and the roles they may play;

facilitate the derivation of requirements on UMTS, as seen from the point of view of the involved actors.

4.1 Overview of the UMTS Role Model

The role model has been developed in the following steps:

- identification of entities (e.g. persons, legal entities, or machines) involved as actors in UMTS service provision and use,
- identification of relationships between actors involved in the provision and use of UMTS services,
- definition of roles of actors within the relationships.

A simplified representation of the resulting role model is depicted in figure 1:

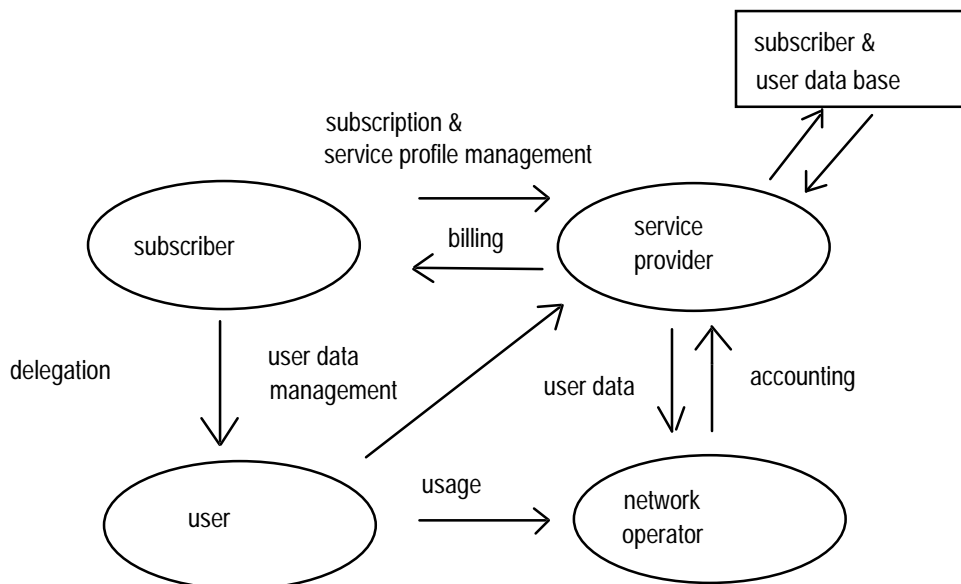


Figure 1: Simplified role model

A more detailed role model is provided by UMTS 09.01 (DTR/SMG-50901U) [4].

4.2 Relationships in the provision and use of UMTS services

The following paragraph briefly describes the relationships identified in figure 1:

- subscription is a contractual relationship (i.e. basically a commercial) between two actors, one in the role of subscriber, the other in the role of service provider. It defines, amongst others things, the services subscribed to, the tariffs that will be applied.
- delegation is a relationship between two actors, one in the role of subscriber, the other in the role of user, in which the subscriber authorises the use of (a part of) the telecommunication services subscribed to; this authorisation is implemented in a user service profile.
- service profile management is a relationship between two actors, one in the role of user, the other in the role of service provider, devoted to modification of the relevant user service profile(s) data.
- usage of a telecommunication service, as agreed at subscription, involves two actors, one in the role of user, the other in the role of network operator, providing the network capabilities that are being used in a particular instance of use of a telecommunication service (i.e., a call); within this relationship, the user uses the network capabilities provided by the network operator to access telecommunication services.
- accounting for the usage of telecommunication services, in the simplest case, is a relationship between two actors, one in the role of network operator, the other in the role of service provider; the first one notifies the latter on the use of telecommunication services by the users of the service provider's customers. This leads to account settlement. The accounting relationship is a prerequisite to billing. Note: This relationship is in general more complex when the use of telecommunication services by users involves more than one network (i.e. originating, destination, and possibly transit networks) and possibly more than one service provider.
- billing for the usage of a telecommunication service, a relationship between the two actors involved in the subscription relationship and where the subscriber receives notification (bill) of the monetary counterpart of the use of telecommunication services by its users. This leads to bill settlement.

4.3 Description of Roles

Subscriber is a role in which a person or other entity has a contractual relationship with a service provider on behalf of one or more users. A subscriber is responsible for the payment of charges due to that service provider.

User is a role in which a person or other entity authorised by a subscriber uses services subscribed to by the subscriber.

Service Provider is the role that has overall responsibility for the provision of a service or set of services to users associated with a subscription and for negotiating the network capabilities associated with that service or set of services with network operators.

Network Operator is the role that provides the network capabilities necessary for the support of the services or set of services offered to users.

A subscriber and a user may be the same entity. The network operator and service provider may be the same entity. A service provider is not constrained to a single network operator, Several network operators may provide network capabilities to a service provider; hence the user is able to roam between network operators.

NOTE: Further refinements to the role model, may be needed, e.g. to cover the hire market, provision of value added services. It may be necessary to include other roles. Some reorganisation of Section 5 may be appropriate in order to relate requirements to roles.

5 System requirements

The objective of this section is to identify the UMTS system requirements from the UMTS objectives, given in the UMTS objectives and system overview [1].

When mapping UMTS objectives to UMTS system requirements it is considered appropriate to justify the requirements identified. In general, the appropriate justification will be given prior to the associated requirements. The justification does not form part of the system requirements as such, and serves purely as background information.

UMTS system requirements are numbered "Rwxyz", where wxyz are digits. Spare numbers are for further use if required.

The numbering scheme and the actual numbers bear no significance with respect to the importance of the requirements. However, logically associated requirements are sought co-located. References to the appropriate UMTS documentation are included with requirements dealing with technical matters. No references are included with requirements arising from commercial, regulatory or political issues since these requirements are of a general nature and must be considered in the drafting of other technical reports and specifications.

The objectives listed in the UMTS objectives and system overview [1] lead to a number of functionally related requirements which can be grouped under the headings such as "mobility", "environment", "quality of service", "terminals" etc. which form the sub section headings of Section 5 "System Requirements". Under each subsection heading the (the UMTS objectives and system overview [1]) objectives covered are listed.

5.1 General

(objectives 3, 4, 9, 12, 13, 14, 18, 19, 20, 21, 25, 33)

UMTS aims to provide mass usage of its telecommunications services. It is expected that mass usage is likely to be realised via single user hand held, portable or vehicle mounted terminals. In particular the biggest mass market terminal is expected to be a small pocket sized personal communicator that is low weight and low cost which provides high quality speech and paging or messaging everywhere. Although speech is still expected to be the most widely used teleservice, it may not be as dominant a teleservice as it is today.

In order to be able to serve a mass market, several requirements relating to the cost of service provision and quality, ease of use and the ability to serve varying user densities have been identified.

UMTS will be aligned with the world wide standard for Future Public Land Mobile Telecommunications Systems (FPLMTS) to provide global terminal roaming and user roaming between regions and between terminals.

Global terminal roaming has implications concerning the standardisation of interfaces (in particular the standardisation of air interfaces and interfaces between networks).

User roaming between UMTS terminals has implications concerning the standardisation of a

- User Identification Module(UIM)/Mobile Terminal(MT) interface.

The regulatory framework for UMTS and UMTS network operators is expected to evolve before and during the lifetime of UMTS, leading to a number of considerations, for example:

- Operators will not generally seek to provide all UMTS services from the "start of service".
- Operators may not be allowed to provide all UMTS services from the "start of service".
- The bandwidth allocated to an operator may not enable a large set of UMTS teleservices to be supported.
- An operator may initially be granted a license to provide a restricted set of services.

- Further bandwidth allocations may be granted to an operator at a later date.
- An operator may be granted further licenses or may have the terms of his/her license changed at a future date.

As a consequence UMTS should facilitate flexibility in terms of infrastructure evolution and deployment, as well as flexibility of service and technology (e.g. codecs) introduction.

Additionally, UMTS is expected to be deployed in a competitive environment. More than one operator may provide service in the same geographic area and the regulatory environment may or may not dictate that operators have different spectrum allocations.

UMTS may be one of the key systems to technologically facilitate a liberalised mobile communications market and reduce the demarcations between mobile and fixed telecommunications.

These considerations lead to the following systems requirements:

R005: The UMTS standard will be aligned with the world wide standard for FPLMTS to provide global terminal roaming and user roaming between regions and between terminals.

R010: [DTR/SMG-50401U] The UMTS standard shall enable the minimum use of radio resource consistent with providing the transmission performance required to provide services in a geographic area (taking into account infrastructure costs).

R015: [DTR/SMG-50401U] For a given spectrum allocation UMTS shall maximise the number of users to which various services can be provided simultaneously within a geographic area (taking into account infrastructure costs).

R016: [DTR/SMG-50301U, DTR/SMG-50401U] UMTS shall be designed so that it is economically viable to deploy UMTS in regions with high as well as low user densities.

R020: [DTR/SMG-50401U] UMTS shall be designed such that its means of delivering services (e.g. disposition of cell sites, spot beams, frequency disposition to areas, etc.) may be changed with minimum impact on any UMTS user or operator.

R025: [DTR/SMG-50301U] It shall be possible for an operator to deploy and operate a UMTS network by utilising equipment supplied by several manufacturers.

R030: It shall be possible for network operators and service providers to introduce new services without impact upon existing users and existing terminal equipment. UMTS should facilitate the flexible and widespread introduction of new services.

R031: It shall be possible for network operators and service providers to introduce new technology with minimum impact upon existing users and terminal equipment.

R040: Various stages for the development of UMTS will be defined to allow the stepwise or phased introduction of services and technology provided by UMTS.

R041: It shall be possible to exploit second generation mobile technology for the realisation of UMTS as long as this does not impair the realisation of UMTS objectives.

R042: It shall be possible to exploit the technology and concepts employed in networks providing telecommunication services to fixed users as long as this does not impair the realisation of UMTS objectives.

R050: [DTR/SMG-50201U, DTR/SMG-50401U] Provision shall be made for terminals to access UMTS services via terrestrial or satellite components.

R060: [DTR/SMG-50401U] UMTS will standardise a minimum number of air interfaces in order to provide service continuity and roaming between environments, between terrestrial and satellite components and between operators.

R061: [DTR/SMG-50401U] In order to facilitate cost savings in the UMTS radio sub-system (including terminals), UMTS radio interfaces shall be standardised with the objective of maximising commonality between those interfaces.

R065: Protocols necessary for the provision of global roaming and user mobility shall be standardised
Note: This does not exclude the possibility of multiple standards per interface or exclude interfaces unrelated to global roaming or user mobility from being standardised.

R070 [DTR/SMG-50401U]: The UMTS standard should provide facilities supporting a plurality of UMTS networks to operate within the same geographic area and frequency band with minimum spectrum co-ordination between networks.

R071: [DTR/SMG-50401U, DTR/SMG-50301U] The UMTS standard should be flexible enough to cater for different licensing and regulatory regimes.

R072: [DTR/SMG-51201U] The choice of satellite constellation shall not be constrained provided the service objectives are met.

R080: [DTR/SMG-50401U] Provision shall be made for the support of teleservices via widely differing spectrum allocations.

R090: [DTR/SMG-50401U] UMTS must meet European health and safety legal requirements concerning electrical and radio equipment. It should accommodate relevant prospective health and safety legal requirements. It must ensure, as far as possible, that human beings, animals and environment do not experience any discomfort and are not harmed by UMTS. UMTS must comply with European EMC directives.

5.2 Migration towards UMTS

(objectives 3, 6, 15, 18, 19, 20, 21)

5.2.1 Introduction

The commercial deployment of UMTS will be influenced by the following key factors:

- infrastructure investment,
- technology,
- developments in the regulatory environment and
- the need for new services.

These will have a significant impact upon UMTS system requirements.

5.2.2 Infrastructure Investment

Operators and manufacturers have made huge existing investments in network infrastructure in terms of development, procurement and operating costs.

Network operators have started and are continuing to operate a variety of different networks and systems, these include fixed networks (N-ISDN, B-ISDN) and mobile networks and systems (GSM, PCS, DECT). Many operators are also adding Intelligent Network (IN) capabilities to enhance their network functionality.

Second generation systems (e.g. DECT, GSM) deployment has generally been later than originally anticipated, with a consequential delay in pay back on investment. A similar situation exists with respect to DECT and pre UMTS satellite-based mobile systems.

GSM/DCS 1800 is likely to be the main second generation mobile system deployed in Europe around 2000-2005 in which operators and manufactures will have invested thousands of millions of ECUs. In the future the cost base per GSM/DCS 1800 subscriber is likely to be much lower than it is today. UMTS is

scheduled to start service around 2000-2005 and the target cost base per UMTS subscriber should be comparable or less than the cost base per GSM/DCS 1800 subscriber.

UMTS is likely to be successful if it is evolvable from fixed networks (N-ISDN/B-ISDN) and second generation mobile systems (GSM/DCS 1800/DECT/PCS).

UMTS aims to be aligned with Future Public Land Mobile Telecommunications Systems (FPLMTS). The development of FPLMTS is likely to be influenced by investments made in contemporary and developing networks and systems (for example: B-ISDN, ITU-IN and in the US: D-AMPS and PCS).

R091: The design of UMTS must consider that the target cost for UMTS system functionality should be comparable or better to that for GSM/DCS 1800 systems.

R092: UMTS aims at the convergence of current mobile and fixed network services with cost efficient re-use and development of functionality for maximum efficiency.

5.2.3 Technology and developments in the regulatory environment

The development of UMTS is taking place against a background of rapid technological and regulatory development.

Around 2000-2005 mobile telecommunications licenses are unlikely to be constrained to a particular standard (this is indicated by the draft CEC green paper on mobile telecommunications). Existing GSM/DCS 1800 operators may want to introduce UMTS technology in their existing frequency bands in order to support more subscribers and in order to provide new services. However the need to support more subscribers or to provide new services may only arise in specific geographic areas and wide area coverage may be more cost effectively provided by the use of lower frequency bands or by the UMTS satellite component. Similarly, operators of pre UMTS satellite-based mobile systems may want to introduce UMTS technology in their existing frequency bands to support more subscribers, to provide new services or to improve the satellite system functionality. The introduction of personal satellite telecommunications will provide for the needs of users when operating outdoors.

Handset technology is likely to have evolved substantially by around 2000-2005 and multimode handsets (e.g. GSM/DCS 1800/DECT) may be common. An integrated cordless/cellular service is likely to be realised by means of second generation mobile systems.

There is likely to be a demand for:

- certain operators to continue to support second generation systems as well as providing UMTS (there will therefore be a need to achieve a "best" cost base by exploiting both second generation systems and UMTS in terms of coverage, capacity and features)
- multimode 2nd generation/UMTS handset which, as far as possible, automatically selects the network which provides the most cost effective service,
- terminal roaming between second generation systems and UMTS and
- SIM/UIM roaming between 2nd generation handsets and UMTS handsets.

Such considerations lead to the following systems requirements:

R093: In order to facilitate the transition towards UMTS deployment, it shall be possible to provide UMTS services in a system which contains components of fixed networks and 2nd generation mobile networks forming an integrated system infrastructure. This includes the provision in UMTS for the integrated deployment of 2nd generation radio technologies as a complement to other UMTS radio technologies.

R094: [DTR/SMG-50401U] It shall be possible for UMTS to be deployed in frequency bands currently occupied by second generation mobile systems (e.g. GSM/DCS 1800).

R095: [DTR/SMG-50401U] Without constraining the UMTS standards, the satellite component of UMTS shall be deployable in frequency bands occupied by pre-UMTS satellite mobile systems.

R096: The UMTS standard must enable the provision of cost effective, efficient interworking with second generation mobile systems and fixed systems. Ideally, seamless service delivery is required, enabling services to be provided transparently across several networks.

R097 [DTR/SMG-50601U] The UMTS standard will enable high quality speech connections to be established between a 2nd generation user or fixed user and a UMTS subscriber.

R098: Provision shall be made for the support of terminal roaming between second generation systems and UMTS. This shall not constrain the UMTS standards.

R099: Provision shall be made for SIM/UIM roaming between second generation handsets and UMTS handsets.

5.2.4 New Services

It is expected that speech will be the most widely used teleservice. Around the time that UMTS is introduced into service, non voice service usage is expected to increase to a higher level than what it is today. Provision of high bit rate services should therefore be provided in such a way that the cost of providing the speech service and other widely used teleservices are not increased.

Many of the services supported by UMTS might not be supported by current second generation systems or by systems evolved from second generation systems. This is likely to be due to limitations of second generation air interfaces and/or the limited spectrum licensed to second generation operators rather than due to fundamental second generation infrastructure limitations. In order to minimise costs, the UMTS air interface should therefore be designed to allow operators to reuse, as far as possible, elements of second generation infrastructure such as cell sites, transmission and switching capabilities.

R100: [DTR/SMG-50401U] As far as possible, UMTS air interfaces should be designed such that the cost of providing widely used services is not increased by their ability to support less widely used services (e.g. services requiring bit rates in excess of 64 kbits/s).

R101: [DTR/SMG-50401U, DTR/SMG-50301U] The UMTS air interfaces should, as far as possible, enable elements of second generation infrastructure (e.g. cell sites, transmission capabilities, switches) to be reused.

5.3 Environment

(objectives 2,8, 32)

Environments adopted in this section express user needs. These environments may overlap (e.g. in some regions the public environment and a domestic environment may overlap) and some selection procedure would appear to be required to determine the appropriate service environment.

The mapping of these user needs to radio operating environments defined in **DTR/SMG-50401** is given by Annex B.

NOTE: This means that some selection procedure is required to determine the environment that should be used.

5.3.1 Service perspective

Services provided will generally vary between environments.

Residential Environment

Within the residential environment, service is normally provided to the residents within a single domestic dwelling or to the residents of a group of domestic dwellings forming a neighbourhood. Service will generally be limited to pedestrian users.

R110: [DTR/SMG-50201U, DTR/SMG-50301U, DTR/SMG-50401U] Within the residential environment it must be possible for a pedestrian user to be provided with services normally provided by the fixed network (PSTN/ISDN and possibly B-ISDN) via the fixed subscriber loop.

R120: [DTR/SMG-50201U, DTR/SMG-50401U] If service is limited to a single dwelling then it must be possible for service to be provided without any cost additional to that normally incurred with respect to use of the fixed network being levied for use of radio spectrum.

R130: [DTR/SMG-50201U, DTR/SMG-50301U, DTR/SMG-50401U] Within the residential environment provision must be made for the support of fixed terminals which would normally be connected via the fixed subscriber loop to the fixed network (PSTN/ISDN/B-ISDN).

R140: [DTR/SMG-50201U, DTR/SMG-50401U] The UMTS standard must enable the provision of providing a uniform set of services within the area covered by a residential environment e.g. UMTS must be capable of providing a residents of a group of domestic dwellings forming a neighbourhood with the same set of services.

R150: [DTR/SMG-50201U, DTR/SMG-50401U] Within the residential environment pedestrian users will not perceive any interruption of service (due to handover, fading etc.).

R160: [DTR/SMG-50901U] It must be possible to exclude non residents from accessing services within a residential environment It must be possible to provide service to authorised non residents within the residential environment.

R170: [DTR/SMG-50901U] Within a neighbourhood it must be possible to exclude specific residents of the neighbourhood from accessing services.

Office Environment

Within the office environment communications services (as provided via PBXs and LANs) are provided to a business (an area from which the general public is normally excluded).

R180: [DTR/SMG-50201U, DTR/SMG-50401U, DTR/SMG-50301U] Within the office environment it must be possible to provide the pedestrian business employee with services normally provided by PBXs and LANs.

R190: [DTR/SMG-50201U, DTR/SMG-50401U, DTR/SMG-50301U] Within the office environment provision must be made for the support of fixed terminals which would normally be connected to PBXs and LANs.

R200: [DTR/SMG-50201U, DTR/SMG-50401U] The UMTS standard must a uniform set of services to be provided within the area covered by an office environment, i.e. UMTS must be capable of providing all employees with the same set of services.

R210: [DTR/SMG-50201U, DTR/SMG-50401U] Within the office environment pedestrian users will not perceive any interruption of service (due to handover, fading etc.).

R220: [DTR/SMG-50901U] Within an office environment it must be possible to exclude persons who are not employees of the business from accessing services; however it must be possible for authorised non employees to access services.

R230: [DTR/SMG-50901U] Within the office environment it must be possible to restrict services offered to certain employees.

Public Environment

This environment provides services to the general public who may be stationary, pedestrian or travelling in vehicles. This environment may also provide private business services to a closed user group of business users. In general services should be provided independent of location (however commercial reasons may dictate that certain services are not provided in certain regions) and independent of user speed (however commercial reasons may dictate that certain services are not possible in environments where users are moving at high speeds).

R240: [DTR/SMG-50201U] Within the public environment service will be provided to the general public.

R250: [DTR/SMG-50201U] It must be possible to provide certain services to a closed user group.

R260: [DTR/SMG-50201U, DTR/SMG-50401U] Within the public environment, service should be provided without interruption (due to handover, fading etc.); however since certain services may be limited to certain geographic regions continuous coverage may not always be possible.

5.3.2 Operational perspective

For operational purposes environments may be classified according to user densities (urban, rural, remote) and propagation factors (type of terrain - hilly, wooded etc., user speed).

R280: [DTR/SMG-50401U] It shall be possible to provide residential, public and office environments in urban, rural and remote areas irrespective of terrain.

R290: [DTR/SMG-50401U] The public environment must cover regions where user speeds may be predominantly, pedestrian or vehicular (e.g. motorways, high speed trains, aeronautical).

5.4 Mobility

(objectives 1,10,11)

In general a user will expect to be provided with service independent of location and whilst on the move. The user will therefore expect to be able to make calls and to receive calls to/from other mobile users and to/from fixed network users independent of location. It should be possible for a user to be provided with service even if he/she enters an area where service coverage is provided by an operator other than the one with whom he/she has subscription. However the user might not be provided with all services in all locations.

R300: [DTR/SMG-50201U, DTR/SMG-50401U] It must be possible for a user to be provided with service in the user's residential environment, in the public environment and in the user's office environment.

R310: [DTR/SMG-50201U, DTR/SMG-50401U] It should be possible for the user

- to move from/to the user's residential environment to/from the public environment (to which the user has subscription) and
- to move from/to the user's office environment to/from the public environment (to which the user has subscription)

without the user perceiving any interruption of service.

R320: [DTR/SMG-50201U, DTR/SMG-50301U] It must be possible for the user to be provided with service in a public environment where coverage is not provided by the operator with whom the user has a subscription (this implies a roaming agreement between the service provider with whom the user has a subscription and the network operator to which the user has roamed).

R330: [DTR/SMG-50201U, DTR/SMG-50401U] UMTS network capabilities shall enable UPT users to access their UPT service provider without having a subscription to a UMTS service provider.

5.5 Terminals

(Objectives 5, 31, 32)

UMTS aims to support a wide variety of mobile terminals - e.g. small lightweight pocket telephones that can be used everywhere, paging terminals, personal digital assistants, palmtop and laptop computers, vehicle mounted terminals and terminals whose mobility is limited due to size and weight.

5.5.1 Terminal types

It would seem necessary for UMTS to support hand-held, portable, vehicle mounted, moveable and fixed terminals.

Hand-held

Hand-held terminals are mobile stations which are carried by hand and are generally used in the hand. Pocket telephones (speech or video phone), personal digital assistants and palmtop computers are examples of potential UMTS hand-held terminal. Hand held terminals are required to be low weight and hence are required to have low power consumption (due to size and weight restrictions imposed by the battery pack). Target performance guidelines for hand held terminals are provided in Annex B.

R400: [DTR/SMG-50201U, DTR/SMG-50401U] Provision shall be made for hand held terminals to support paging, speech, messaging, video, fax, multimedia and data services (file transfer) and/or to support combinations of these services.

R410: [DTR/SMG-50201U, DTR/SMG-50401U] Hand held terminals shall be able to operate continuously for as long as possible on a single battery charge.

Portable

Portable terminals are mobile stations which are normally carried by hand and are used on the lap, desk or table. A laptop computer is an example of a potential UMTS portable terminal. Portable terminals may also be provided specifically to support the connection of equipment intended for connection to fixed networks (PSTN, ISDN, B-ISDN and LANs). Portable terminals are required to be of moderate weight and are required to have a reasonably low power consumption (due to size and weight restrictions imposed by the battery pack). Target performance guidelines for portable terminals are provided in Annex B. Laptop computers should not have their weight significantly increased due to the provision of a UMTS air interface. Laptop computers should not suffer significant reduction in the period of battery operation.

R430: [DTR/SMG-50201U, DTR/SMG-50401U] The UMTS standard must enable the support of portable terminals which provide paging, speech, messaging, video, multimedia and/or data services.

R440: [DTR/SMG-50201U, DTR/SMG-50401U] The UMTS standard must specify interfaces appropriate to laptop computers i.e. laptop computers shall not have their weight significantly increased due to the provision of an interface to UMTS and laptop computers interfacing to UMTS should not suffer a significant reduction in operation time via battery.

Vehicle mounted

Vehicle mounted terminals are physically mounted in a vehicle. The antenna is mounted outside the vehicle and where power to the terminal is supplied by physical connection to the vehicle. Hand held and portable terminals could be used within vehicles and certain terminals may be designed to be dual mode - hand held/vehicle mounted or portable/vehicle mounted. The vehicle may be a car, motorcycle, truck, bus, train, ship, aircraft etc.

Moveable

These are large heavy mobile stations which cannot be hand carried and whose power is generally supplied from some external source. A moveable terminal may operate as a fixed terminal since it may be taken to a location and may then be switched on in order operate.

Fixed

These operate from a fixed location and power is usually provided by an external source. Fixed terminals may be used to allow the provision of services to fixed terminal equipment and to connect PBXs. Fixed terminals may also function as docking stations for laptop PCs.

5.5.2 Interfaces

UMTS will provide for single user terminals and multiple user terminals. A UMTS mobile terminal may be connected via internal interfaces (e.g. ISA, EISA, PCMCIA) to other terminal equipment to access UMTS services via an air interface. UMTS terminal equipment may also be connected to other terminal equipment via an interface at an S or R reference point.

R460: [DTR/SMG-50201U, DTR/SMG-50301U, DTR/SMG-50401U] It should be possible for hand held, portable, vehicle mounted and fixed terminals to permit the connection of terminal equipment designed to operate via connection to fixed networks (PSTN, ISDN, PSPDN etc.) via an interface at an R and/or S reference point.

R480: [DTR/SMG-50201U, DTR/SMG-50401U, DTR/SMG-50301U] It should be possible for vehicle mounted, moveable and fixed terminals to permit the connection of PBXs which are designed to operate via connection to ISDN or B-ISDN via interfaces at T and TB reference points.

5.5.3 Services

R490: [DTR/SMG-50201U] Provision shall be made for hand held terminals to support paging, speech, messaging, video, fax, and data (file transfer) or to support combinations of these services.

R500: [DTR/SMG-50201U, DTR/SMG-50401U] The UMTS standard shall make provision for portable, vehicle mounted, moveable and fixed terminals to support several users, or user applications, simultaneously using speech, messaging, video, multimedia and data service.

5.6 Services

(objectives 4, 6, 9, 15, 16, 17, 22, 23, 24, 29, 30, 32)

UMTS aims to support a wide range of teleservices and supplementary services. UMTS aims to support many teleservices some of which are not currently supported by 2nd generation mobile systems (e.g. video, multimedia services, high speed data). UMTS also aims to provide services normally offered by 2nd generation public cellular, domestic cordless, private mobile radio, and paging networks as well as providing services normally provided via fixed subscriber loop. It will not be feasible (due to economic as well as technical reasons) to provide all services in all environments and via satellite as well as via the terrestrial component of UMTS. As far as possible UMTS aims to provide services of a quality which is comparable to fixed networks. UMTS also aims to provide a means to connect PBXs or rural exchanges. More than one operator may provide services in the same geographic area.

R610: [DTR/SMG-50201U] Provision shall be made for terminals to support calls to the emergency services. Provision shall also be made for terminals to support location, navigation and other road traffic management services in the public environment.

R640: [DTR/SMG-50201U, DTR/SMG -50401U] UMTS shall support quality of service appropriate to user requirements.

R650: [DTR/SMG-50201U, DTR/SMG -50401U] Quality of service relating to connection establishment and release shall be significantly better than those of 2nd generation mobile systems. Transmission related parameters (i.e. throughput, residual error rate, delay) may differ according to teleservice requirements; however provision shall be made for throughputs of up to 2 Mbits/s, residual error rates of better than $10E-6$, and delays of less than 100 ms for the terrestrial component and delays of up to 310 ms for the satellite component of UMTS.

R660: [DTR/SMG-50201U, DTR/SMG-50401U] It shall be technically possible to provide speech, messaging, video, and data services requiring throughputs of up to 128 kbits/s in all environments.

R670: [DTR/SMG-50201U, DTR/SMG-50401U] In the office environment, the UMTS standard shall provide the capability of providing services requiring throughputs of more than 128 kbits/s and up to 2 Mbits/s in the office environment.

R700: [DTR/SMG-50201U, DTR/SMG-50401U] In rural or remote areas, the UMTS standard shall provide the capability of providing services requiring throughputs of up to 2 Mbits/s.

NOTE: R650 and R660 do not exclude the possibility of several interfaces being utilised to provide services in a particular environment. For example: one air interface could be utilised for services requiring lower throughput rates (e.g. up to 64 kbits/s) and another could be utilised for services requiring higher throughputs (e.g. more than 64 kbits/s). Air interfaces utilised for the satellite component of UMTS could also differ from those utilised for the terrestrial component of UMTS. UMTS aims to standardise a minimum number of air interfaces (see R060) and to maximise commonality between air interfaces (see R61), however this must be balanced with regard to ensuring that the cost of supporting more widely used services is not increased by the ability to support less widely used services (see R100). It should also be noted that the spectrum allocated to the satellite component and practical power limitations may not enable the support of throughput rates equivalent to the terrestrial component.

R710: [DTR/SMG-50201U] Where a UMTS operator claims to provide service it should conform to the standard specified for UMTS.

R730: [DTR/SMG-50301U] It should be possible for the user to be able to select the network operator which is to provide service in an area covered by more than one operator.

R740: [DTR/SMG-50301U] In an area covered by more than one network operator it must be possible for the user to select certain services from one operator and to obtain certain other services from another operator.

R750: [DTR/SMG-50201U] UMTS shall provide as options -

the ability to initiate an emergency call:

- without a UIM being inserted and/or without personally identifying the user or;
- with a UIM inserted and no personal identification of the user or;
- with a UIM being inserted and the personal identification of the user;
- when out going calls are barred and/or;
- when the credit limit is exceeded.

R760: [DTR/SMG-50201U] UMTS shall provide the ability to initiate emergency call when a UIM is inserted

- when outgoing calls are barred and/or;
- when the user's credit limit is exceeded.

5.7 Interworking

(objective 7)

Calls to or from UMTS terminals may terminate or originate in other networks (in fixed networks such as PSTN, ISDN, B-ISDN, PSPDN, CSPDN or in mobile networks).

NOTE: UMTS should support the necessary means for interconnection required to provide service transparency by independent Service Providers.

R.800: [DTR/SMG-50301U] UMTS shall cater for interworking of communications between the UMTS and PSTN, ISDN, B-ISDN, PSPDN, CSPDN, and second generation mobile systems.

5.8 Numbering

(objective 27)

A user or terminal should be able to roam between the domestic environment, public environment and office environment and between different operators in the public environment. A user may be expected to subscribe to a public operator in order to be provided with service in the public environment. A user should be able to obtain different services from more than one network operator at a time (one operator may offer different services from another or one operator may offer certain services at more competitive rates than others). A user may choose to stop subscription to one service provider and subscribe to another. The number used to reach a user should be independent of the subscription. It should be possible to reach a user independent of the geographical location and independently of the particular network operator which provides coverage over the area where the user is located.

It should be possible for private numbering plans to be adopted within office environments and used within closed user groups in public environments. Users of closed user groups will be reachable via a private subscription by others outside of a particular closed user group or office environment.

R900: [DTR/SMG-50201U, DTR/SMG-50301U] The diallable number allocated to a user should be independent of subscription to any particular operator.

R910; [DTR/SMG-50201U, DTR/SMG-50301U] It shall be possible for the user to change subscription to another service provider without the need to change the diallable number by which he/she is reachable and without the need to be allocated any additional number.

(Note: R900 and R910 may prove to be rather ambitious.)

R920: [DTR/SMG-50201U, DTR/SMG-50301U] In the residential environment the user will be reached by a number which conforms to Recommendation E.164.

R930: [DTR/SMG-50201U, DTR/SMG-50301U] In the public environment the user will be reached by a number which conforms to Recommendation E.164. It will be possible to establish a call to a user via this number independent of the location of user.

R940: [DTR/SMG-50201U, DTR/SMG-50301U] In the public environment it will be possible to reach the user by a single number even if the user roams into a region served by another operator and/or service provider (subject to roaming agreements between operators).

R950: [DTR/SMG-50201U, DTR/SMG-50301U] In the office environment the user will be reached by public network users by a number which conforms to Recommendation E.164. Provision will be made for private numbering plans to be used within an office environment.

R960: [DTR/SMG-50201U, DTR/SMG-50301U] It will be possible to reach a user via a single diallable number even though the user may roam between residential, public and office environments.

5.9 Management

(objectives 12, 19, 20)

UMTS will provide an open architecture which permits the easy introduction of new technology and further applications/services. This leads to network management requirements related to the planning, provisioning, installation, maintenance, operation and administration of UMTS. Ideally UMTS management should be defined using the ITU and ETSI recommended TMN approach and concepts. The management concepts and related architecture defined for IN, PSTN, ISDN, B-ISDN and 2nd generation mobile systems (particularly GSM) should be used, where appropriate, to define UMTS management.

R970: [DTR/SMG-50501U] UMTS shall have the ability of controlling itself as far as possible.

R975: [DTR/SMG-50501U] UMTS should be able to report events and reactions, in order to enable remote control and to simplify maintenance intervention.

R980: [DTR/SMG-50501U] UMTS management standards shall be based, where appropriate, upon standards developed by ISO, ITU and ETSI for Public Land Mobile Networks (particularly GSM), IN, ISDN and B-ISDN.

5.10 Billing

(objective 26)

The success of UMTS within the public environment will depend upon its ability to profit from the provision of service to users. It is therefore necessary to bill users in terms of services provided.

R1000: [DTR/SMG-50201U] It shall be possible for the service provider to bill a subscriber on a regular basis.

R1010: [DTR/SMG-50201U] It must be possible for a user to receive bills only from those service providers with whom the user has a subscription and it will be possible for the user to make and receive calls whilst roaming to areas covered by other operators with whom the subscriber has no subscription.

R1011: [DTR/SMG-50201U] It must be possible for network operators to bill service providers accurately and promptly (including the possibility of billing on a call by call basis and during long calls) even when service provision permits roaming to more than one operator.

5.11 Security

(objective 26)

In residential, public and office environments it is necessary to prevent unauthorised access to services and resources.

In the public environment it may be appropriate to trace stolen terminal equipment and to trace users who misuse the services provided by an operator (e.g. it may be appropriate to trace users who make emergency calls or who make malicious or obscene phone calls). In the public environment it will generally be appropriate to bar access to users who are not credit worthy.

Conversations should be secure from eavesdropping and data delivered should be free from alteration or corruption by 3rd parties.

R1100: [DTR/SMG-50201U, DTR/SMG-50901U, DTR/SMG-50301U] It shall be possible to ensure privacy of data (user identities, location, information carried between users etc.) and to detect unauthorised alteration of data during transmission.

R1105: [DTR/SMG-50201U, DTR/SMG-50901U, DTR/SMG -50301U] It shall be possible to ensure the privacy of data during storage.

R1110: [DTR/SMG-50201U, DTR/SMG-50901U, DTR/SMG-50301U] It shall be possible to prevent misuse of resources and services through the impersonation of customers or providers.

R1120: [DTR/SMG-50201U, DTR/SMG-50901U, DTR/SMG-50301U] It shall be possible to enable authorised entities to control the use of resources and services by other entities

R1130: [DTR/SMG-50201U, DTR/SMG-50901U] It shall be possible to ensure the privacy of a user's location from other users involved in a call and from unauthorised entities generally.)

Annex A (Informative): 1st and 2nd Generation systems

2nd generation and analogue mobile systems have provided services which have frequently been classified as being provided by domestic cordless, domestic neighbourhood, fixed subscriber loop replacement, public cellular and paging applications. UMTS intends to unify, from a service perspective, these diverse systems. This section provides a brief overview of these systems. The implementation schemes described will not necessarily be adopted by UMTS.

Domestic cordless

This provides communications services within a small cell (around 100m in diameter) covering the subscriber's domestic dwelling (i.e. the subscribers premises and garden). Mobility is provided within the cell. The base station providing coverage is normally connected to the fixed network (PSTN/ISDN) via fixed subscriber loop (or by fixed subscriber loop replacement). The domestic cordless application normally uses unlicensed spectrum and the subscriber is expected to own or rent base station and terminal equipment. The subscriber is charged only for normal PSTN/ISDN calls.

Domestic neighbourhood

This provides communications services within a cell (around 1 km in diameter) covering a neighbourhood. Mobility is provided within the cell to pedestrian users. The base station providing coverage is normally connected to the fixed network (PSTN/ISDN) via fixed subscriber loop (or by fixed subscriber loop replacement).

Fixed subscriber loop replacement

This is used to replace or instead of the fixed wire loop between the subscriber's premises and the local exchange by radio transmission. All supplementary services, teleservices and end user applications are transparently supported from the end user perspective by the radio transmission medium. No terminal mobility is provided. The user is provided with exactly the same terminal as would be provided with respect to the fixed subscriber loop. The terminal is fixed and is wired to the transmitter/receiver located on the subscriber's premises. The antenna is normal located at roof top height.

Private business

This provides communications services (as provided by PBXs and LANs) to a private area (an area from which the general public is excluded). Handover and roaming between cells is provided. The application provides high bit rate services to stationary users. Unlicensed spectrum is likely to be used.

Public cellular

This provides personal communications services with extensive mobility (a range of mobile speeds are normally supported) to the general public. A variety of different diameter cells may be used. Handover and roaming between cells is required.

Paging

This enables a short message, a paging message to be delivered to a mobile paging terminal. No confirmation of delivery is normally provided and no messages are sent by the paging terminal. No authentication or security is provided by the network and the paging terminal is required to accept only those paging messages which are addressed to it.

Annex B (Informative): Mapping of user needs to radio operating environments

Service Env.	Applic. Area	Mobility	Service Reqs. (minimum targets)	User Speeds (km/h)	Delivery	Radio Op. Env.	Radio Prop.
Residential (see 1)	Domestic Cordless	restricted (see 3)	128 kbps	0 - 10	ter.	home	indoor/ outdoor
	Domestic Neigh.	restricted (see 5)	128 kbps	0 - 10	ter.	neighbourhood	indoor/ outdoor
			128 kbps - 2 Mbps	0 (see 10)	ter	urban ped.	outdoor
	Fixed Subscriber Loop Rep.	none (see 6)	128 kbps - 2 Mbps	0 (fixed)	ter.	fixed	outdoor
		none	128 kbps	0 (fixed)	sat.	fixed sat	outdoor
	no equiv.	restricted (see 9)	2 Mbps	0 - 10	ter	local high bit rate	indoor/ outdoor
Public	Public Cellular	full	128 kbps	0 - 10	ter.	urban ped.	outdoor
				0 - 100	ter.	urban vehicular	outdoor
				0 - 100	sat.	urban sat.	outdoor
				0 - 10	ter	neighbourhood	indoor/ outdoor
				0 - 500	ter.	rural outdoor	outdoor
				0 - 1500	sat.	rural sat.	outdoor
				0 - 1500	ter	ter. aero	outdoor
			2 Mbps	0 (see 11)	ter	local high bit rate	indoor/ outdoor
	Paging (see 8)	full	600 bps	0 - 10	sat.	indoor sat.	indoor/ outdoor
Office (see 2)	Private Business	restricted (see 7)	2 Mbps	0 - 10	ter.	business indoor	indoor
		none	2 Mbps	0 (fixed)	ter.	fixed	outdoor
		none	128 kbps	0 (fixed)	sat.	fixed sat.	outdoor

- 1) Members of the general public are normally excluded from the residential environment and service is normally limited to those users who would normally reside within a particular residential environment.
- 2) Members of the general public are normally excluded from the office environment and service is normally limited to those users who are normally employed within or reside within that office environment.
- 3) The public cellular application area may provide service in the residential environment and in the office environment.
- 4) In the residential environment service may be limited to the area within which the user normally resides. The domestic cordless application area will limit service to the area covering the user's home and garden.

- 5) In the domestic neighbourhood application area service will be limited to the area covering a block of flats or group of buildings.
- 6) In the fixed subscriber loop replacement application area service will be limited to fixed terminations.
- 7) In the private business application area service will be limited to the area covering the group of buildings which constitute the office environment.
- 8) The paging service may be provided in any environment and by any application area. We need to consider whether provision of a paging only service to pedestrian users only can be classified as UMTS.
- 9) High bit rate services may be provided within a small area within the residential environment
- 10) Service may only be provided to stationary users; however service is not necessarily restricted to stationary users (pedestrian speeds might be accommodated).

General Comments/Concerns

Most public cellular environments seem to be limited to outdoor propagation only. Consequently sparsely populated areas require the use of at least 2 radio operating environments to provide coverage to within buildings and outdoors i.e. via neighbourhood and rural outdoor. We have no radio environment suited to public cellular which can provide service to the residential environment.

Annex C (Informative): UMTS terminal capabilities:

This Annex provides some initial views concerning UMTS terminal capabilities. The text is taken from Section 3.8 of the UMTS Task Force Report [11].

UMTS must enable single terminal solutions with terminating call routing for a range of radio environments, in particular for indoor and wide-area outdoor. These should be based either on interworking of respective optimised systems and dual-mode terminals or on flexible air-interface dynamically optimised to the respective radio environment.

UMTS must provide, for example

- a range of terminals, from speech only to advanced multi-media terminals,
- user friendliness,
- excellent standby and talk-time performance, for example standby > 10 days, talk time > 5 hours,
- software downloading to terminals,
- transfer of service logic,
- low transmit power,
- weight below 100 grams for basic terminals.

History

Document history	
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