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Technical Specification

**Universal Mobile Telecommunications System (UMTS);
UMTS phase 1
Approved at SMG#28, Approved CRs at SA#2 Florida
(Provisional) (UMTS 22.00 version 3.1.0)**



UMTS

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Foreword

This draft Technical Specification has been produced by the Special Mobile Group (SMG) Technical Committee of the European Telecommunications Standards Institute (ETSI).

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

Version 2.y.z

where:

- x the first digit:
 - 1 presented to SMG for information;
 - 2 presented to SMG for approval;
 - 3 Indicates SMG approved UMTS document.
- y the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the specification;

1 Scope

The UMTS system will be defined in a phased approach. This document specifies the content of the first phase of requirements for UMTS. Some requirements affecting phase 1 to ensure a smooth transition to later releases are also indicated.

2 References

References may be made to:

- a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or
- b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or
- c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or
- d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

2.1 Normative references

This document is the starting point of the set of specifications that define the UMTS Service Requirements for UMTS Phase 1. The UMTS Service requirements for UMTS phase 1 are defined in the following normative specifications.

- [1] UMTS 22.01: "Universal Mobile Telecommunications System (UMTS): Service aspects; Service principles".
- [2] UMTS 22.05: "Universal Mobile Telecommunications System (UMTS); Services and Service Capabilities".
- [3] UMTS 22.15: "Universal Mobile Telecommunications System (UMTS); Service Aspects: Charging and Billing".
- [4] UMTS 22.20: "Universal Mobile Telecommunications System (UMTS); VHE Stage 1".
- [5] [UMTS TS ??, Handover requirements between UMTS and GSM or other Radio System]".

These specifications may refer (directly or indirectly) to further specifications which provide detailed descriptions of service requirements incorporated in UMTS. In particular the service requirements of any GSM component of a UMTS system are specified by reference to GSM service requirements specifications.

3 Definitions, and abbreviations

3.1 Definitions

Definitions applicable to current document :

CAC (Connection Admission Control) : is a set of measures taken by the network to balance between the QoS requirements of new connections request and the current network utilisation without affecting the grade of service of existing/already established connections.

Capability Class : is a piece of information which indicates general UMTS mobile station characteristics (e.g. supported radio interfaces,...) for the interest of the network.

Connection mode : characterizes the type of association between two endpoints as required by the bearer service for the transfer of information. A bearer service is either connection-oriented or connectionless. In a connection oriented mode, a logical association called *connection* needs to be established between the source and the destination entities before information can be exchanged between them. Within the connection, information is delivered to the destination entity in the same order as it was provided by the source entity. Connection oriented bearer services lifetime is the period of time between the establishment and the release of the connection.

In a connectionless mode, no connection is established beforehand between the source and the destination entities ; the source and destination network addresses need to be specified in each message. Transferred information cannot be guaranteed of ordered delivery. Connectionless bearer services lifetime is reduced to the transport of one message.

FC (Flow Control) : is a set of mechanisms used to prevent the network from becoming overloaded by regulating the input rate transmissions.

GSM BSS : refers in this specification to the GSM/GPRS access network.

GSM core network : refers in this specification to the GSM NSS and GPRS backbone infrastructure.

Home environment : enables a user to obtain UMTS services in a consistent manner regardless of the user's location or terminal used (within the limitations of the serving network and current terminal).

Performance : is concerned with the ability to track service and resource usage levels and provides feedback on the responsiveness and reliability of the network.

Serving network : provides the user with access to the services of home environment.

UMTS core network : refers in this specification to an evolved GSM core network infrastructure or any new UMTS core network infrastructures, integrating circuit and packet switched traffic..

UMTS mobile termination : part of the UMTS Mobile Station which provides functions specific to the management of the radio interface (Um).

UMTS network: refers to a network operated by a single network operator and consisting of :
 UTRAN access networks (WCDMA and/or TD-CDMA),
 optionally GSM BSS access networks,
 an UMTS core network.

UPC (Usage Parameter Control) : is a set of actions taken by the network to monitor and control the offered traffic and the validity of the connection with respect to the traffic contract negotiated between the user and the network.

Further definitions [Tbd]

3.2 Abbreviations

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

BSS	Base Station System
CDMA	Code Division Multiple Access
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
NSS	Network Sub System
PC	Personal Computer
QoS	Quality of Service
SIM	GSM Subscriber Identity Module
TD-CDMA	Time Division-Code Division Multiple Access
UICC	UMTS IC Card
UMTS	Universal Mobile Telecommunications System
USIM	User Service Identity Module

UTRAN	UMTS Terrestrial Radio Access Network
VHE	Virtual Home Environment
WCDMA	Wideband Code Division Multiple Access

4 UMTS phasing and releases overview

The UMTS system will be defined in a phased approach. This specification addresses the UMTS phase 1 capabilities for RELEASE '99.

The UMTS phase 1 requirements can be met by the capabilities of GSM phase 2+ release 99 including specific enhancements for UMTS. Additional developments to fully meet the requirements for UMTS phase 1 standardisation are listed in this specification.

The fundamental difference between GSM and UMTS phase 1 resides in the support of high bit rate bearer services with the notion of negotiated traffic and QoS characteristics. UMTS phase 1 shall in particular support bursty and asymmetric traffic in an efficient way. This shall allow UMTS phase 1 to support single- and multi-media N-ISDN applications and single- and multi-media IP applications.

The phase 1 USIM is developed on the basis of the phase 2+ release 99 SIM. When UMTS specific requirements have not been stated in this specification it is assumed that the GSM phase 2+ release 99 specifications for the SIM is adopted for the UMTS phase 1 requirements.

No specific requirement is addressed for the mobile termination since it relates to the UMTS access stratum and to the UMTS core network (depending whether peer entities end either in the access or in the core).

Regarding the phase 1 standardisation of UMTS access network, only the UTRAN (including all UTRA modes if several modes are defined) is considered as being part of the UMTS access network. Other types of access networks are for further consideration. UTRAN is a new access network and as such all the UTRAN requirements are defined in this specification. This includes in particular the interoperability requirements put on the UTRAN and GSM BSS access networks to cater with UMTS networks operating the two types of access networks.

UMTS phase 1 shall be developed in such a way that it supports compatibility with an evolved GSM network from the point of view of roaming and handover. This could be achieved by evolving from a GSM phase 2+ network but does not exclude other developments. Therefore, phase 1 specifications shall allow operators to introduce new technologies (such as ATM, IP,...). An overall UMTS system approach is needed for UMTS phase 1 development as it is more than the addition of a UTRAN to a GSM Phase 2+ architecture. Requirements to the GSM phase 2+ core network for UMTS should be incorporated.

To enable operators to utilize the network resources efficiently, the optimization of the signaling load as well as the reduction of the required overall transmission capacity is a critical success factor. Therefore the standard should aim for an architecture with minimal signaling traffic and optimized transmission infrastructure. If advantageous common mobility management and common subscriber data management for CS and PS traffic should be implemented in all relevant network elements. Furthermore the standard should support an integrated node (MSC/SGSN) for PS and CS traffic as well as separated nodes as in GSM/GPRS.

From the viewpoint of the necessity of providing multi-vendor environments, interfaces within the UTRAN (such as Iub) shall be standardized. However, since operator dependent O&M requirements over these interfaces may exist, specifications should be able to be expanded flexibly according to operator specific requirements

It should be noted that the advanced bearer capabilities of the phase 1 UMTS access network may not be fully supported by the phase 1 UMTS core network. This however guarantees the viability of the UMTS access network to allow the scope within phase 1 to support broadband bearer services.

A standard default speech codec shall be standardised for UMTS phase 1. UMTS should support tandem free operation from day 1 to enable lower transmission and equipment costs and for higher speech quality. Crossphase compatibility issues in transcoder location should be considered when moving from Phase 1 UTRAN to later releases.

4.1 Post UMTS Phase 1 operation

After phase 1, the new capabilities of UMTS shall be defined in annual releases where each release constitutes a coherent set of specifications covering UMTS mobile station, access network and core network .

UMTS phase 1 should facilitate evolution towards a single integrated core network infrastructure.

The introduction of Phase 1 UMTS shall not limit or restrict the evolution to later UMTS releases, however, the different starting points to introduce UMTS need to be taken into account.

Cross Phase compatibility shall be considered from day 1 and should include the following aspects:

- 1) Terminals (e.g. support of phase1 terminals in later releases of UMTS networks and vice-versa).
- 2) Signalling and protocols, including UTRAN to Core Network, inter network and terminal to network.
- 3) Security aspects (e.g. the relationship of GSM and UMTS security mechanisms).

Efficient mechanisms for communicating versions and managing cross phase issues shall be designed into the UMTS system from the very start. The mechanisms should be applicable to any components of the system that are planned to be, or might in the future be, phased. These principles might be applicable to : Hardware, Firmware, Software, APIs.

5 Services

UMTS phase 1 will enable the introduction of a range of new services (e.g. Internet services and Multimedia) and applications with the concept of service capabilities. The service capabilities are bearer services defined by parameters (e.g. QoS attributes) and mechanisms needed to realise services.

5.1. Teleservices and supplementary services

UMTS phase 1 shall at least support the following GSM teleservices currently handled by GSM : speech, emergency call and SMS. UMTS phase 1 shall support these teleservices as stated below :

Speech: A default speech codec shall be specified to provide speech service across the UTRAN and GSM access networks. The selected speech codec shall operate with no discernible loss of speech on handover between the GSM access network and the UTRAN.

Short Message Service-Point to Point (SMS-PP): A short message service point to point shall be provided seamlessly (as far as the user or the users terminal equipment is concerned) across the UMTS and GSM access network. Additional features are planned for SMS in **Release 99**.

Short Message Service-Cell Broadcast (SMS-CB): A short message service cell broadcast shall be provided seamlessly (as far as the user or the users terminal equipment is concerned) across the UMTS and GSM network.

Supplementary Services : The standard shall support GSM Release '99 supplementary services. The control of such supplementary services shall be the same as for GSM, from the user's perspective.

NOTE : Transfer of data to/from facsimile machines in the PSTN/ISDN should be supported seamlessly (as far as the user or the user's terminal is concerned) across the UMTS and GSM access network. It is envisaged that the main use of fax in the mobile environment will be via PCs. UMTS will not support direct end-to-end communication using T.30. Instead a store and forward service is envisaged where some kind of file transfer program is used to transfer text or images to a store and forward unit for subsequent delivery to the facsimile machine in the PSTN/ISDN. The user (or the users PC) may receive notification of successful delivery of the fax. No standardisation of a fax store and forward service is planned and it is envisaged that roaming subscribers will be supported via the VHE.

5.2. Bearer services

UMTS phase 1 shall support GSM phase 2+ Release '99 data bearer services :

Circuit switched data: Circuit switched data services and "real time" data services shall be provided for interworking with the PSTN/ISDN so that the user is unaware of the access network used (UMTS and GSM access network or handover between access networks). Both transparent (constant delay) and non-transparent (zero error with flow control) services shall be supported. These data services shall operate with minimum loss of data on handover between the GSM access network and the UTRAN.

Packet switched data: Packet switched data services shall be provided for interworking with packet networks such as IP-networks and LANs. The standard shall provide mechanisms which ensure the continuity of packet based services upon handover e.g. between GSM and UMTS.

6 UTRAN capabilities

NOTE : The term performance refers in this clause to the realisation of the QoS objectives inside the UTRAN.

UTRAN capabilities for UMTS are the complete set of bearer capabilities and bearer control specified in UMTS 22.05. The UTRAN shall have the following capabilities :

- 1) A UTRAN shall be contained within only one UMTS network. (In the case of a network with a phase 1 UMTS core network consisting of an evolved GSM core network, it shall be possible to connect the UTRAN to the GSM NSS and GPRS backbone infrastructures or only one of them.)
- 2) The UTRAN shall support the set-up, re-negotiation and clearing of connections with a range of traffic and performance characteristics. The re-negotiation may result from an upper layer request or a change in the radio conditions (handover, cell load modification,...) and may be mobile station or network initiated. It shall be possible for the UTRAN to apply the following traffic policing mechanisms such as :
 - . connection admission control (CAC) during connection set-up and re-negotiation,
 - . flow control (FC) on a connection during its lifetime,
 - . usage parameter control (UPC) on a connection during its lifetime..
- 3) The UTRAN shall support a range of traffic and performance characteristics for the connectionless traffic.
- 4) The range of traffic and performance characteristics that shall be supported by UTRAN for connection oriented and connectionless traffic is indicated in TS 22.05 sections 5.2 to 5.4.
- 5) The UTRAN shall allow one mobile termination to handle more than one bearer service simultaneously and to have bearer services of different connection modes. It is nevertheless expected that the terminal and network capabilities will put some limitations on the number of bearer services that can be handled simultaneously. It shall be possible for each connection to have independent traffic and performance characteristics. It shall be possible for each connectionless message to have independent traffic and performance characteristics.
- 6) Seamless handover of active bearer service(s) from a single mobile termination, between cells of one UTRAN shall be supported. This shall result in an imperceptible loss of speech (if any) for the user of telephony services and without incurring degradation of QoS for data services.
- 7) At least one Capability Class shall be standardised for mobile terminals supporting more than one UTRA mode (e.g. UTRA FDD and TDD modes). It shall support monitoring of the different types of cells in idle mode (cell reselection procedure) and active mode (handover preparation procedure).
- 8) For UMTS networks composed of UTRANs with different UTRA modes, the cell selection and the paging procedures shall accommodate to the fact that service areas may be covered by cells supporting one specific mode (e.g. FDD or TDD mode), and cells supporting more than one mode (e.g. FDD and TDD modes).
- 9) Handover of one mobile termination handling one or more bearer services between cells of two UTRANs using different UTRA modes and operated by one single UMTS network operator shall be supported in both directions. Furthermore, handover between cells using two different UTRA modes should be supported similarly to handover within one mode.

- 10) The UTRAN shall facilitate determination of the location of a UMTS mobile termination. The realisation of a positioning service can be determined by several methodologies, namely *mobile-based positioning*, *network-based positioning*, or a *hybrid position* architecture. It shall be possible for the location precision to be a UMTS network operator choice, with the precision of the location varying from one part of the service area to another. It shall be possible to achieve a minimum precision of around 50 meters in all types of terrestrial radio environments. Location requirements are detailed in UMTS 22.05 subclause 8.5.
- 11) The UTRAN shall support the Localised Service Area (LSA) concept. It shall facilitate user-dependent radio resource selection based on LSA (e.g. when user is located at his office, radio coverage provided with indoor radio solutions should be preferred). Corresponding GSM feature has been specified in GSM 02.43.
- 12) The optimisation of the UTRAN radio interface shall be based upon the objectives expressed in UMTS 22.05 clause 5.
- 13) Standardised protocols shall be defined for the operation, administration and maintenance of each of the UTRAN components in UMTS phase 1 in cooperation with ETSI TMN.
- 14) The USIM requirements defined for later releases of UMTS should be taken into account in the design of UTRAN (for any impact).

7 UTRAN and GSM BSS relationship

There is a special relationship between the UTRAN and GSM access networks as it is expected that UTRANs will start as islands in a sea of GSM BSS. GSM BSS access networks will be a key element for service continuity in UMTS networks. The requirements are the following for UMTS phase 1 :

- 1) UMTS phase 1 shall support dual mode UMTS/GSM terminals. At least one Capability Class shall be standardised for mobile terminals supporting the GSM and UTRA modes. It shall support monitoring of cells belonging to the two types of access networks in idle mode (cell reselection procedure) and active mode (handover preparation procedure).
- 2) Cell selection and paging procedures shall be designed to accommodate to the fact that networks may consist of GSM BSS cells, UTRAN cells or a combination of both.
- 3) For UMTS networks composed of both GSM BSS and UTRAN access networks, handover of bearer services shall be supported between GSM BSS and UTRAN cells, in both directions (i.e. UTRAN to GSM BSS and GSM BSS to UTRAN). Some traffic flows may be re-negotiated, temporarily released or re-established during these handover procedures because of the different bearer capabilities of the GSM BSS and UTRAN access networks.

8 UMTS Core Network

NOTE 1: The term performance refers in this clause to the resource level usage and reliability of the UMTS core network.

NOTE 2: SMG1 does not use the (circuit switched) notion of call to define UMTS phase 1 core network capabilities. If SMG12 decides to use this notion to fulfil SMG1 requirements, it shall be noted that it is not required for phase 1 UMTS core networks to support calls with multiple connections. Multiple connections for a single mobile could be realised through several calls.

In the first phase of UMTS, the UMTS core network capabilities are a superset of the phase 2+ release 99 GSM core network capabilities. The additional requirements for the phase 1 UMTS core network are the following :

- 1) The phase 1 UMTS core network shall support circuit switched data service capability of at least 64 kbit/s per user. *This shall not limit the user from choosing lower data rates.*
- 2) The phase 1 UMTS core network shall support packet switched data service capabilities of at least 2 Mbit/s peak bit rate per user. *This shall not limit the user from choosing lower data rates.*

- 3) The phase 1 UMTS core network shall enable set-up, re-negotiation and clearing of connections with a range of traffic and performance characteristics. It shall be possible to apply traffic policing (e.g. connection admission control, flow control, usage parameter control...) on a connection during its set-up and lifetime.
- 4) The phase 1 UMTS core network shall support a range of traffic and performance characteristics for connectionless traffic.
- 5) The range of traffic and performance characteristics that shall be supported by the phase 1 UMTS core network for connection oriented and connectionless traffic shall be at least those of GPRS phase 2+ release 99. This means that the support of the full set of bearer services defined in TS 22.05 section 5.2 to 5.4 is not required for the phase 1 UMTS core network.
- 6) Point to multipoint communication configurations as defined in TS 22.05 shall be supported by the phase 1 UMTS core network.
- 7) The phase 1 UMTS core network shall allow one mobile termination to handle more than one bearer service simultaneously and to have bearer services of different connection modes. It is nevertheless expected that the terminal and network capabilities will put some limitations on the number of bearer services that can be handled simultaneously. It shall be possible for each connection to have independent traffic and performance characteristics. It shall be possible for each connectionless message to have independent traffic and performance characteristics.
- 8) In order to facilitate the development of new applications, it shall be possible to address applications to/from a phase 1 UMTS mobile termination in connection oriented and connectionless traffic modes (e.g. the notion of Internet port).
- 9) Operator specific services based on the VHE concept shall be provided by the phase 1 UMTS core network. This functionality could be provided through available toolkits (such as CAMEL, MExE, WAP and SIM Toolkit).
- 10) If UMTS authentication is invoked while a user has services active, the authentication shall not degrade the user services.
- 11) The phase 1 UMTS core network shall support the generation of standardised charging records based upon parameters such as the dialled number, call duration, traffic (volume, bit rate) and perceived Quality of Service provided to the user.
- 12) The phase 1 UMTS core network shall support on-line billing. Billing of 3rd party value added services with the concept of one-stop-billing shall be supported by the phase 1 UMTS core network through standardised procedures.
- 13) The phase 1 UMTS core network shall support both bilateral and (possibly via 3rd party) automatic roaming procedures to UMTS networks with improved security as defined by SMG10.
- 14) The phase 1 UMTS core network shall support interworking with PSTN, N-ISDN, GSM, X.25 and IP networks with their respective numbering schemes.
- 15) It shall be possible for the standardised classes of phase 1 UMTS mobile terminals supporting the GSM BSS and UTRAN radio interfaces to roam in GSM networks and receive GSM services.
- 16) Standardised protocols shall be defined for the operation, administration and maintenance of the UMTS phase 1 core network in cooperation with ETSI TMN.
- 17) The USIM requirements defined for later releases of UMTS should be taken into account in the design of the phase 1 UMTS core network.

9 USIM

In the first phase of UMTS, the USIM shall be developed on the basis of the phase 2+ release 99 GSM SIM. The additional requirements for the phase 1 UMTS USIM are as follows :

- 1) USIM shall provide new and enhanced security features (e.g. mutual authentication...) as defined by SMG10.
- 2) The UMTS mobile terminal shall support phase 2 and phase 2+ GSM SIMs as access modules to UMTS networks. The services that can be provided in this case may be limited to GSM like services provided by that UMTS network. UMTS mobile terminals shall not support 5V SIMs. It shall be up to the UMTS network operator to accept or reject the use of GSM SIM as access modules in its network.
- 3) It shall be possible to have multiple applications on the UMTS IC Card (UICC). There shall be a secured and easy mechanism for application selection. An authorised access for each application is mandatory, however it shall be possible to have shared directories between applications where appropriate. The UICC shall be capable of supporting SIM and USIM applications.
- 4) Simultaneous activation of several USIMs on one mobile terminal need not be supported in UMTS phase 1.
- 5) A standardised mechanism allowing highly secure transfer of applications and/or associated data to/from the UICC shall be supported in UMTS phase 1.

10 Security Features

With respect to the GSM security mechanisms the following additional features may be implemented for UMTS phase 1 if required by SMG10 :

- 1) Mutual authentication between user and serving network, between user and home environment and between serving network and home environment
- 2) Confidentiality of user and signalling data to and within the access network (and possibly into the core network)
- 3) End to end encryption (as an optional service) between UMTS users, with access to plaintext for lawful interception purposes
- 4) TTP (trusted 3rd party) mechanisms, including public key techniques and associated certificates and signing, verification and revocation procedures used, for example, before accessing 3rd party services.
- 5) Authentication, confidentiality and integrity of signalling between UMTS network (both core and access) nodes
- 6) Confidentiality of the user identity on the radio interface.

Annex A (informative) :

Change history

Change history					
SMG No. / TSG SA#	TDoc. No.	CR. No.	Section affected	New version	Subject/Comments
SMG#28				Version 3.0.0	Approved
SA#2 Florida	SP-99015	001	5	Version 3.1.0	Cell Broadcast Service in UMTS
SA#2 Florida	SP-99015	002	4	Version 3.1.0	Addition and clarification of general Operator requirement for 3G System
SA#2 Florida	SP-99015	007	4.1	Version 3.1.0	UMTS and Cross Phase Compatibility

History

Document history		
october 1998	v1.0.0	presented to SMG #27
5 th of november 1998	v1.1.0	updated during Rome meeting according to comments expressed in Tdocs 646, 662
6 th of november 1998	v.1.2.0	section 5 completed during Rome meeting
16 th of november 1998	v.1.2.1	updated
23 rd of november 1998	v.1.3.0	updated according to the comments of the 1 st week after the Rome meeting
25 th of november 1998	v.1.4.0	updated
11 th of december 1998	v.1.5.0	updated
25 th of december 1998	v.1.6.0	updated
08 th of january 1999	v.1.6.1	editorial updates
January 1999	v.2.0.0	Version 2.0.0 agreed by SMG1 by correspondence
February 1999	v3.0.0	Version 3.0.0 approved by SMG#28
March 1999	V3.1.0	Version 3.1.0 (Applied in anticipation of approval at SA#2 in Florida)