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Title: ARIB's Requirements and Objectives for 3G Mobile Services and System

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Abstract:
IMT-2000 is the ITU defined third generation mobile system concept and were in the past named Future Public Land Mobile Telecommunication Systems (FPLMTS). IMT-2000 is scheduled by ITU to start service around the year 2000 subject to market considerations. They will provide access, by means of one or more radio links, to a wide range of telecommunication services supported by the fixed telecommunication networks (e.g. PSTN/ISDN) and Internet, and to other services which are specific to mobile users.

The Japanese interpretation of IMT-2000 is called in this Volume as a 3G Mobile System. This Volume sets out the objectives and requirements for a 3G Mobile System which should be used in the design and development of the remaining Volumes of the ARIB standard specifications.

The scope of this Volume covers general objectives, operating environments, services, systems requirements, network management, satellite components and fixed wireless access applications of a 3G Mobile System.

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Volume 1

Requirements and Objectives for 3G Mobile Services and System

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Notice

Authorization work for this document is under processing by System working group of ARIB and not yet to complete for the time being.

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Requirements and Objectives for 3G Mobile Services and System

1 Introduction

1.1 Scope

IMT-2000 is the ITU defined third generation mobile system concept and were in the past named Future Public Land Mobile Telecommunication Systems (FPLMTS). IMT-2000 is scheduled by ITU to start service around the year 2000 subject to market considerations. They will provide access, by means of one or more radio links, to a wide range of telecommunication services supported by the fixed telecommunication networks (e.g. PSTN/ISDN) and Internet, and to other services which are specific to mobile users.

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1.2 Definitions and Terminology

Vocabulary of terms used in this Volume is found in Annex 1.

1.3 References

This Volume has been developed, taking into account the objectives and requirements specific to the Japanese environments of a 3G Mobile System deployment, based on the following ITU Recommendations which give the general objectives and requirements for the IMT-2000.

Recommendation ITU-R M.687:	Future Public Land Mobile Telecommunication Systems (FPLMTS)
Recommendation ITU-R M.816:	Framework for Services Supported by FPLMTS
Recommendation ITU-R M.817:	FPLMTS network architecture
Recommendation ITU-R M.818:	Satellite Operation within FPLMTS
Recommendation ITU-R M.819:	FPLMTS for Developing Countries
Recommendation ITU-R M.1034:	Requirements for the Radio Interface(s) for FPLMTS
Recommendation ITU-R M.1035:	Framework for the Radio Interface(s) and Radio Sub-system Functionality for FPLMTS
Recommendation ITU-R M.1036:	Spectrum Considerations for Implementation of FPLMTS in the Bands 1 885-2 025 MHz and 2 110-2 200 MHz
Recommendation ITU-R M.1078:	Security Principles for FPLMTS
Recommendation ITU-R M.1079:	Speech and Voiceband Data Performance Requirements for FPLMTS
Recommendation ITU-R M.1167:	Framework for the Satellite Component of FPLMTS

Recommendation ITU-R M.1168:	Framework of FPLMTS Management
Recommendation ITU-R M.1224:	Vocabulary of Terms for FPLMTS
ITU-R Land Mobile Handbook	
Recommendation ITU-T E.105:	International Telephone Service
Recommendation ITU-T E.171:	International Telephone Routing Plan
Recommendation ITU-T F.115:	Operational and Service Provisions for FPLMTS
Recommendation ITU-T F.851:	Universal Personal Telecommunication (UPT): Service description
Recommendation ITU-T G.114:	One-way Transmission Time
Recommendation ITU-T G.174:	General Characteristics of International Telephone Connections and International Telephone Circuits; Transmission Performance Objectives for Terrestrial Digital Wireless Systems Using Portable Terminals to Access to the PSTN
Recommendation ITU-T G.722:	7 kHz Audio-coding within 64 kbit/s
Recommendation ITU-T G.726:	40, 32, 24, 16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM)
Recommendation ITU-T G.729:	Coding of Speech at 8 kbit/s Using Conjugate-structure Algebraic-code-excited Linear-prediction
Recommendation ITU-T H.263:	Video Coding for Low Bit Rate Communication
Recommendation ITU-T M.3020:	TMN Interface Specification Methodology
Recommendation ITU-T M.3400:	TMN Application Functions
Recommendation ITU-T T.30:	Procedures for Document Facsimile Transmission in the General Switched Telephone Network
Recommendation ITU-T X.509:	The Directory - Authentication Framework
Recommendation ITU-T X.722:	Structure of Management Information - Guidelines for the Definition of Managed Objects
MPT1:	Report of Study Group on the Next Generation Mobile Communications Systems, Study Group Organised by Ministry of Posts and Telecommunications, June 3, 1997.

2 Overview of 3G Mobile Services and System

2.1 General Concept (ITU-R Land Mobile Hand Book Sec.2)

A 3G Mobile System is scheduled to start service around the year 2000. It will provide access, by means of one or more radio links, to a wide range of telecommunication services supported by the fixed telecommunications networks (e.g., PSTN/ISDN) and Internet, and to other services which are specific to mobile users. A range of mobile terminal types is encompassed, linking to terrestrial or satellite-based networks, and the terminals may be designed for mobile or fixed use.

Key features of the 3G Mobile System are:

a) high degree of commonality of design worldwide;

b) compatibility of services within the 3G Mobile System and with the fixed networks;

c) high service quality;

d) high speed data service;

e) use of a small pocket terminal worldwide.

IMT-2000 will operate worldwide in bands identified by Radio Regulation provision No. 746A(1885 - 2025 and 2110 - 2200 MHz, with the satellite component limited to 1980 – 2010 and 2170 – 2200 MHz). A part of these frequency bands will be used in a 3G Mobile System.

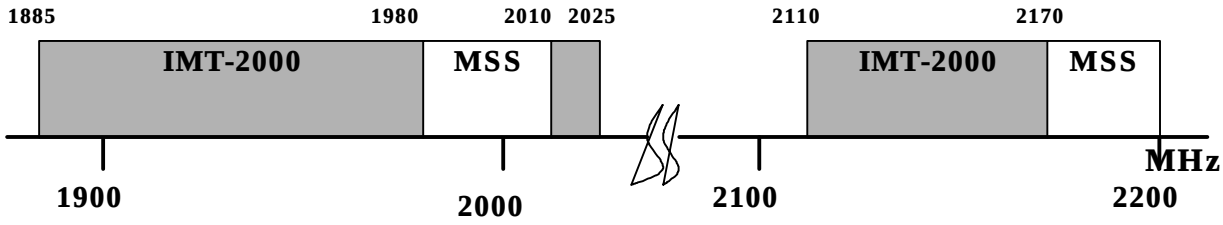

FIG. 2-1 Frequency Plan for IMT-2000

2.2 System Image

FIG.2-2 System Image

2.3 General Requirements and Objectives of 3G Mobile System

(1) Global System (ITU-R Land Mobile Hand Book)

- a global standard promoting a high degree of commonality of design worldwide while incorporating a variety of systems;
- use of a small pocket terminal worldwide, but also the accommodation of a variety of other terminal types;
- bigger marketplace leading to lower costs;
- worldwide common frequency band;
- worldwide roaming based on terminal mobility;
- worldwide, off-the-shelf compatible equipment.

(2) New Services and Capabilities (ITU-R Land Mobile Hand Book)

- provision of capability which enables new voice and data services which are significantly more advanced than pre-3G Mobile System technologies;
- availability to mobile users of a range of voice and non-voice services, including packet data and multimedia services;
- higher service quality, in particular voice;
- high quality and integrity, comparable to the fixed network;
- significantly higher user bit rate capability;
- flexible radio bearer;
- the capability to provide bandwidth on demand supporting a wide range of data rates, from simple low rate paging messages through voice to high rates associated with video or file transfer;
- support for asymmetrical data capabilities which require high rates in one direction but much lower rates in the other;
- to aid the emergency services by providing additional emergency call information as far as possible, e.g. user identity, location information, and other information that may be required by national or local authorities,
- improved security;
- improved ease of operation;
- coherent systems management based on ITU-T M.3000-series of Recommendations.

(3) Evolution and Migration (ITU-R Land Mobile Hand Book)

- flexibility for evolution of systems, and migration of users, both from a pre-3G Mobile System and evolution within a 3G Mobile System;
- compatibility of services within a 3G Mobile System and with the fixed telecommunications network (e.g., PSTN/ISDN);
- provision of a framework for the continuing expansion of mobile network services and access to services and facilities of the fixed network;

- an open architecture which will permit easy introduction of advances in technology, e.g. interference cancellers to improve the link capacity, and of different applications;
- ability to coexist and interwork with a pre-3G Mobile System.

(4) Flexibility: Multi-environment Capabilities (ITU-R Land Mobile Hand Book)

- accommodation of a maximum level of interworking between networks of different types to provide customers with greater coverage, seamless roaming and consistency of services;
- provision of services by more than one network in any coverage area;
- provision of these services over a wide range of user densities and coverage areas;
- provision of services to both mobile and fixed users in urban, rural and remote regions;
- wider range of operating environments;
- a modular structure which will allow the system to start from as small and simple a configuration as possible and grow as needed, in size and complexity;
- caters to needs of developing countries;
- flexibility to utilize adaptive software downloadable terminals to support multiband and multi-environment capabilities;
- key parameters of bandwidth, transmission quality and delay can be selected, negotiated, mixed and matched by the requirements of the service according to the instantaneous capability of the radio-frequency channel;
- better (e.g., more efficient) use of the radio spectrum than a pre-3G Mobile System consistent with providing services at acceptable costs, taking into account their differing demands for data rates, symmetry, channel quality, and delay.

2.4 Operating Environments

The 3G Mobile System environments are as follows;

(1) indoor in the office and/or home at stationary or on the move.

(2) Outdoor in urban, suburban, rural, hilly or coastal areas of a pedestrian or vehicle operation, terrestrial or satellite operation and maritime or aeronautical operation.

Broad categories for the relative speed between the base stations and the mobile stations, corresponding to above operating environments, will be provided.

2.5 Service

[TBD]

3 Objectives (ITU-R M.687-2, Sec.1)

3.1 General Objectives (ITU-R M.687-2, Sec.1.1)

A 3G Mobile System aims to achieve the following primary general objectives:

- to make available to users who are on the move or whose location may change (mobile users), irrespective of their location (i.e. national and international roaming), a wide range of telecommunication services (voice and non-voice), allowing communication between mobile users and other mobile users, users of the fixed public networks (PSTN, PDNs and ISDN) or other telecommunication networks as appropriate; **(ITU-R M.687-2,Sec.1.1.1)**

General objectives related technical objectives are below:

- **Spectrum Efficiency :** to make efficient and economical use of the radio spectrum consistent with providing service at an acceptable cost; **(ITU-R M.687-2,Sec.1.1.3)**
- **Flexible Extensibility of Services :** to provide for the continuing flexible extension of service provision, subject to the constraints of radio transmission, spectrum efficiency and system economics; **(ITU-R M.687-2,Sec.1.1.5)**
- **Phased Development :** to adopt a phased approach for the definition of a 3G Mobile System. The first phase (Phase 1) includes those services supported by minimum user bit rates at least 144 kbit/s for Vehicular Environments, 384 kbit/s for Outdoor to Indoor and Pedestrian Environments, 2,048 kbit/s for Indoor Office Environments and 9.6 kbit/s for Satellite Environments. Phase 2 is envisaged as augmenting Phase 1 with new services, some of which may require higher bit rates; **(ITU-R M.687-2,Sec.1.1.6)**
- **Wireless Local Loop Functions :** to permit the use of a 3G Mobile System for the purpose of providing its services to fixed users, under conditions approved by the appropriate national or regional authority, either permanently or temporarily, either in rural or urban areas; **(ITU-R M.687-2,Sec.1.1.7)**
- **Accommodation for a variety of Mobile Terminals :** to accommodate a variety of mobile terminals ranging from those which are small enough to be easily carried by a person (the personal pocket radio) to those which are mounted in a vehicle; **(ITU-R M.687-2, Sec.1.1.8)**
- **Relation with Satellite Communication :** to allow the coexistence with, and interconnection with, mobile systems which use direct satellite links taking into consideration ITU-T Recommendation E.171; **(ITU-R M.687-2,Sec.1.1.11)**
- **[Relation with other Mobile Networks :** to coexist and interwork with pre-IMT-2000(evolutionary). **(Revision 1 to Document 8-1/TEMP/123-E, 27 February 1997, Sec.7.1"IMT-2000 Characteristics and Functionalities")]**
- **Provision for the Expansion of Networks :** provision of a framework for the continuing

expansion of mobile network services and access to services and facilities of the fixed network (revolutionary from the radio perspective).

(Revision 1 to Document 8-1/TEMP/123-E, 27 February 1997, Sec.7.1"IMT-2000 Characteristics and Functionalities")

- **Safety and EMC :** to meet requirements of the current relevant international safety requirements and legislation for health hazards, and appropriate EMC (Electromagnetic compatibility) regulations.
- **Capacity :** capacity of a 3G Mobile System, in case of all the channels are used for speech, should be equal to, or better than 2G mobile systems (PDC Half-Rate).

General objectives related operational objectives are below:

- **Coexistence of Multiple Service Networks :** to admit the provision of service by more than one network in any area of coverage; **(ITU-R M.687-2,Sec.1.1.9)**
- **Open Architecture :** to provide an open architecture which will permit the easy introduction of technology advancements, as well as different applications; **(ITU-R M.687-2, Sec.1.1.10)**
- **Expandability of Network :** to provide a modular structure which will allow the system to start from as small and simple configuration as possible and grow as needed, both in size and complexity within practical limits. **(ITU-R M.687-2,Sec.1.1.12)**
- **Evolution and Migration :** flexibility for evolution of systems, and migration of users, both from pre-IMT-2000 and evolution within IMT-2000 (evolutionary).

(Revision 1 to Document 8-1/TEMP/123-E, 27 February 1997, Sec.7.1 "IMT-2000 Characteristics and Functionalities")

General objectives related service objectives are below:

- **Service Coverage :** to provide these services over a wide range of user densities and geographic coverage areas; **(ITU-R M.687-2,Sec.1.1.2)**
- **Service Quality :** to provide, as far as practical, services with a quality of service comparable to the fixed networks; **(ITU-R M.687-2,Sec.1.1.4)**

3.2 Technical Objectives (ITU-R M.687-2, Sec.1.2)

A 3G Mobile System aims to achieve the following primary technical objectives:

- **Support of Integrated Services :** to support integrated communication and signalling; **(ITU-R M.687-2,**

Sec.1.2.1)

- **Standardization of Interface :** to establish signalling interface standards, taking into account the principles established by ITU-T Recommendation X.200, and based on the relevant ITU-T signalling Recommendations. **(ITU-R M.687-2,Sec.1.2.2)**

A 3G Mobile System aims to achieve the following secondary technical objectives:

- **Security Functions :** to provide for additional levels of security (for voice and data services) compared to that contained in Service Quality of § 3.1. In addition, to allow for the provision of end-to-end encryption for voice and data services;

(ITU-R M.687-2, Sec.1.2.3)

- **Flexibility of Services :** to provide service flexibility which permits the optional integration of services such as mobile telephone, dispatch, paging and data communication, or any combination thereof; **(ITU-R M.687-2,Sec.1.2.4)**
- **Support of Terminal Interfaces for Fixed Networks :** to support terminal equipment interfaces (and procedures) defined for the fixed public networks which allow the alternative use of terminal equipment in the fixed public networks;

(ITU-R M.687-2, Sec.1.2.5)

- **Operating Conditions :** to support equipment and component design that can withstand typical rural conditions (rough roads, dusty environment, extreme temperatures and humidity, etc.); **(ITU-R M.687-2,Sec.1.2.6)**
- **Repeater Functions :** to accommodate the use of repeaters for covering long distances between terminals and base stations, providing this does not constrain the specification of the radio interfaces; **(ITU-R M.687-2,Sec.1.2.7)**
- **Private Use :** to allow the connection of PABXs or small rural exchanges to mobile stations; **(ITU-R M.687-2,Sec.1.2.8)**
- **Identification of Entities :** procedures used in a 3G Mobile System should be based on the unique identification of the entities (e.g. service providers, network operators, etc.) involved. **(ITU-R M.687-2,Sec.1.2.9)**

3.3 Operational Objectives **(ITU-R M.687-2, Sec.1.3)**

A 3G Mobile System aims to achieve the following primary operational objectives:

a) Authentication and Identification of User

- to provide for the required user authentication and billing functions;

(ITU-R M.687-2, Sec.1.3.1)

- to provide for unique user identification and numbering in accordance with appropriate

ITU-T Recommendations; **(ITU-R M.687-2,Sec.1.3.2)**

– to provide for a unique equipment identification scheme; **(ITU-R M.687-2,Sec.1.3.3)**

b) Service Negotiation and Restriction

– to enable each mobile user to request particular services, and initiate and receive calls, as desired. These calls for a given mobile user, incoming or outgoing at the same mobile termination, may be simultaneously multiple and associated to different services (i.e., advanced voice and data services including multimedia); **(ITU-R M.687-2,Sec.1.3.4)**

– to ensure that the opportunity for fraud in a 3G Mobile System is minimized, e.g. by restricting services such as multiple call forwarding which are prone to fraud; **(ITU-R M.687-2, Sec.1.3.5)**

c) Security and Emergency Functions

– to ensure that the theft of a 3G Mobile System mobile stations is minimized, e.g. by maintaining a list of stolen mobile station identities and monitoring traffic for their use; **(ITU-R M.687-2, Sec.1.3.6)**

– to minimize theft, fraud and also abuse of the emergency service by malicious calls, by having available relevant information for use by the appropriate authorities; **(ITU-R M.687-2, Sec.1.3.7)**

– to aid the emergency services by providing additional emergency call information as far as possible, e.g. user identity, location information, and other information that may be required by national or local authorities. **(ITU-R M.687-2,Sec.1.3.8)**

A 3G Mobile System aims to achieve the following secondary operational objectives:

– **Indication of Charge :** to provide an indication to the paying party of eventual added call charges, e.g. due to roaming; **(ITU-R M.687-2,Sec.1.3.9)**

– **Configuration for Special Conditions :** to allow the system to be configured for special conditions where mobility between cells, or even within a cell, is not required; or where a high traffic per user is required; **(ITU-R M.687-2,Sec.1.3.10)**

– **Consideration of Road Traffic Management :** to take account of the communications requirements for road traffic management and control systems; **(ITU-R M.687-2, Sec.1.3.11)**

– **Flexible Cell Size :** to allow for extension of the cell size in rural or remote areas, providing this does not constrain the specification of the radio interfaces. **(ITU-R M.687-2, Sec.1.3.12)**

3.4 Service Objectives

(M.816, Sec.4.2 (Revision 1 to Document 8-1/TEMP/97-E25 February 1997))

A 3G Mobile System aims to achieve the following primary service objectives:

a) Variety of Services

- **Multimedia Services :** to provide a capability which enables existing as well as new audio, video, data and multimedia services, which are significantly more advanced than pre-IMT-2000 technologies, both packet and circuit switched and connection oriented and connectionless services are envisaged; **(M.816,Sec.4.2)**
- **Flexible Bearer :** to provide flexible radio bearers; **(M.816,Sec.4.2)**
- **Bandwidth-on-demand :** to provide capability for bandwidth-on-demand supporting a wide range of data rates, from simple low rate paging messages through voice to significantly higher rates associated with video or file transfer; **(M.816,Sec.4.2)**
- **Asymmetrical Services :** to support asymmetrical data capabilities, which require high rates in one direction but much lower rates in the other; **(M.816,Sec.4.2)**
- **Range of Telecommunication Services :** to provide a wide range of telecommunications services to mobile or fixed users by means of one or more radio links; **(M.816,Sec.4.2)**
- **Quality of Services :** to ensure that services shall, as far as possible, be identical to those offered to users of fixed telecommunications terminals (connected to fixed telecommunication networks) and with a comparable quality of service; **(M.816,Sec.4.2)**
- **Robust Signalling Interface :** to provide a robust signalling interface that is required to support those services not dependent upon a bearer capability; **(M.816,Sec.4.2)**
- **Equality of Services :** to make these services available for mobile terminals located anywhere subject only to constraints of economic provision, and to limitations of implementation timing; **(M.816,Sec.4.2)**
- **Flexibility of Service Provision :** to provide for flexibility of service provision, for example, between mobile terminal categories and on a geographical or user density basis; **(M.816,Sec.4.2)**
- **Other Specific Services :** to provide for services subject to mobile terminal type, location, and availability from the network operator; **(M.816,Sec.4.2)**

b) Roaming Services

- **Roaming Capability :** to ensure that the user of the personal station -when roaming between networks shall have available (provided the personal station has the necessary capabilities); **(M.816,Sec.4.2)**
  - an indication of the service availability;
  - access to voice telephony;
  - Universal Personal Telecommunication(UPT), and
  - access to a selection of data services;
- **International Roaming :** to provide for worldwide roaming. **(M.816,Sec.4.2)**

4. General Considerations on Operating Environments

This section describes genaral consideration on operating environments for a 3G Mobile System.

4.1 Radio Operating Environments (ITU-R M.1034, Sec.7)

4.1.1 Characteristics of Radio Operating Environments (ITU-R M.1034, Sec.7.1)

3G Mobile System radio operating environments are characterised by a range of attributes which in some way may impact on the 3G Mobile System radio sub-system. These attributes include:

4.1.1.1 Network Attributes (ITU-R M.1034, Sec.7.1.1)

System application areas for a 3G Mobile System are characterised by the purpose of the system coverage. The 3G Mobile System application areas may vary significantly in terms of the type of 3G Mobile System network used for the system application area. These various network types may in turn impose differing requirements on the radio interface(s). Some examples of 3G Mobile System application areas may include:

– public cellular applications,
– private business applications,
– residential cordless applications,
– fixed subscriber loop replacement,
– residential neighbourhood applications,
– mobile base station applications,
– paging applications.

3G Mobile System modes of delivery are characterised by the fundamental network implementation, but may not be seen by the users. Two distinct 3G Mobile System modes of delivery are defined:

– terrestrial based infrastructure,
– satellite based infrastructure.

3G Mobile System modes of delivery are to a great extent independent of the system application areas above, but each mode of delivery may not be applicable in all system application areas.

4.1.1.2 Physical Attributes (ITU-R M.1034, Sec.7.1.2)

Propagation effects are determined by the physical location of the 3G Mobile System base stations and the 3G Mobile System mobile stations. Propagation effects in this respect may thus vary according to, for example:

– indoor and/or outdoor operation,
– outdoor operation in urban, suburban, rural, hilly or coastal areas,
– terrestrial or satellite operation,
– land, maritime, or aeronautical operation.

4.1.1.3 User Attributes (ITU-R M.1034, Sec.7.1.3)

Usage characteristics are given by the situation in which 3G Mobile System mobile user uses the services. These may vary according to, for example:

– usage at home, in the office or on the move,
– the expected traffic demand,
– the approximate service information rates to be provided over the 3G Mobile System radio interface(s).

The relative speed between the 3G Mobile System base stations and the 3G Mobile System mobile stations may vary due to movement of either the 3G Mobile System mobile stations or the 3G Mobile System base stations. Broad categories for this relative speed include:

– stationary (0 km/h),
– pedestrian (up to 10 km/h),
– typical vehicular (up to 100 km/h),
– high speed vehicular (up to 500 km /h),
– aeronautical (up to 1,500 km/h),
– satellite (up to 27,000 km/h).

4.1.2 Identification of Radio Operating Environments (ITU-R M.1034, Sec.7.2)

The 3G Mobile System radio operating environments and their modes of delivery are identified in Table 4-1[1].

These radio operating environments are described in greater detail below. In all cases the propagation ranges, mobile speeds, etc. represent typical values only, and are not meant to be restrictive. In all cases, the propagation path considered is between the mobile unit and its serving base station; that is, the second radio interface of a mobile base station or repeater lies outside the described environment. The expected service information rates, however, will be given by the weakest link in the chain.

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[1] 1 ITU proposes to evaluate the system under such four test environments as indoor office, outdoor to indoor and pedestrian, vehicular and satellite environment, grouping them from the whole environments (ITU-R M. 1225, Annex 2).

Table 4-1

3G Mobile System Operating Environments

Environments	Propagation ranges	Vehicular speeds
(1) Business indoor environment	around 100 m	0 - 10 km/h
(2) Neighbourhood indoor/outdoor environment	around 1km	0 - 10 km/h
(3) Home environment	around 100 m	0 - 10 km/h
(4) Urban vehicular outdoor environment	around 1 to 5 km	0 - 100 km/h
(5) Urban pedestrian environment	around 100 m to 5 km	0 - 10 km/h
(6) Rural outdoor environment	around 5 to 35 km	0 - 500 km/h
(7) Terrestrial aeronautical environment	around 500 km	0 - 1,500 km/h
(8) Fixed outdoor environment	around 1 to 100 km	stationary
(9) [Local high bit rate environment] *1	around 100 m	0 - 10 km/h
(10) Urban satellite environment	[around 100 to 200 km]*2	0 - 100 km/h
(11) Rural satellite environment	[around 100 to 300 km]*2	0 - 1,500 km/h
(12) Satellite fixed-mounted environment	[around 100 to 300 km]*2	stationary
(13) Indoor satellite environment	[around 100 to 200 km]*2	0 - 10 km/h

*1: Further study is required for bit rate of higher than 2 Mbit/s
*2: Spotbeam radius
[ ] : Different ranges from ITU-R M.1034

Some considerations leading up to the choice of 3G Mobile System radio operating environments identified above are given in Annex 2.

4.1.2.1 Business Indoor Environment (ITU-R M.1034, Sec.7.2.1)

The business indoor environment encompasses indoor propagation over ranges up to around 100 m in an office environment, with zero to pedestrian mobile speeds (0-10 km/h). Very high traffic requirements are expected in this environment.

4.1.2.2 Neighbourhood Indoor/Outdoor Environment (ITU-R M.1034, Sec.7.2.2)

The neighbourhood indoor/outdoor environment encompasses outdoor and indoor propagation over ranges up to around 1 km in a residential area, with zero to pedestrian mobile speeds (0-10 km/h). Low traffic requirements are expected in this environment.

An example of such an environment is an environment where services are provided to one or more users in or near their residences through a base station located in the close vicinity of their residences.

4.1.2.3 Home Environment (ITU-R M.1034, Sec.7.2.3)

The home environment encompasses indoor and outdoor propagation over ranges up to around 100 m in and around the home, with zero to pedestrian mobile speeds (0-10 km/h). Very low traffic requirements are expected in this environment.

4.1.2.4 Urban Vehicular Outdoor Environment (ITU-R M.1034, Sec.7.2.4)

The urban vehicular outdoor environment encompasses outdoor propagation in urban areas, over ranges up to around 1-5 km, with zero to typical vehicular mobile speeds (0-100 km/h).

Urban outdoor propagation is characterised by frequent shadowing of the signal and multipath mostly due to buildings, and base stations located on the ground at limited heights. High traffic requirements are expected in this environment.

4.1.2.5 Urban Pedestrian Outdoor Environment (ITU-R M.1034, Sec.7.2.5)

The urban pedestrian outdoor environment encompasses outdoor propagation in urban areas, over ranges up to around 100 m to 5 km, with zero to pedestrian mobile speeds (0-10 km/h).

Urban outdoor propagation is characterised by frequent shadowing of the signal and multipath, mostly due to buildings, and base stations located on the ground at limited heights. High traffic requirements are expected in this environment.

4.1.2.6 Rural Outdoor Environment (ITU-R M.1034, Sec.7.2.6)

The rural outdoor environment encompasses outdoor propagation in rural areas over ranges up to around 5-35 km, with zero to high speed vehicular mobile speeds (0-500 km/h). Rural outdoor propagation is characterised by shadowing of the signal and multipath mostly due to mountains and trees, and base stations located on the ground at limited heights. Medium traffic requirements are expected in this environment.

4.1.2.7 Terrestrial Aeronautical Environment (ITU-R M.1034, Sec.7.2.7)

The terrestrial aeronautical environment encompasses outdoor propagation to users within airplanes over ranges up to around 500 km, with mobile stations moving at aeronautical speeds (0-1 500 km/h). Low traffic requirements are expected in this environment. It should be noted that this environment may also be treated as a special case of the rural outdoor environment.

4.1.2.8 Fixed Outdoor Environment (ITU-R M.1034, Sec.7.2.8)

The fixed outdoor environment encompasses outdoor propagation in urban and/or rural areas over ranges up to around 1 to 100 km, with stationary mobile stations. Low traffic requirements are expected in this environment.

An example of such an environment is an environment where services are provided to a user using a fixed radio link as a part of the subscriber loop, i.e. a radio link between a fixed radio distribution point in the network and a radio end-point on the customer's premises which provides a network termination point into which a fixed or cordless apparatus may be connected.

The propagation in this fixed case is characterised by an optimised positioning of the mobile station, and possibly use of directive antennas, so that multipath and blocking possibly can be avoided to some extent, and/or that longer ranges can be achieved.

NOTE 1 – The propagation conditions for fixed terrestrial applications in urban and rural areas may be somewhat different. However, giving due weight to the relative importance of fixed applications with respect to mobile applications in a 3G Mobile System, it is not justified to identify separate radio operating environments for these applications.

4.1.2.9 Local High Bit Rate Environment (ITU-R M.1034, Sec.7.2.9)

The local high bit rate environment encompasses indoor and/or outdoor propagation over ranges up to around 100 m with zero to pedestrian mobile speeds (0-10 km/h). Typically, such an environment would consist of a dedicated base station for very high bit rate services located at selected spots covering a small area. High traffic requirements are expected in this environment.

4.1.2.10 Urban Satellite Environment (ITU-R M.1034, Sec.7.2.10)

The urban satellite environment encompasses outdoor propagation ranges with zone (or spotbeam) radius up to around 100 to 200 km in urban areas. Medium traffic requirements are expected in this environment.

Since the traffic capacity is limited in the satellite environment, the priority use of a terrestrial channel should be considered when both satellite and terrestrial channels are available.

The mobile earth stations may be moving with zero to typical vehicular speeds (0-100 km/h), and the space stations (satellites) may be moving with speeds (relative to ground) from practically zero to satellite speeds (0-27,000 km/h). The range and the relative speed in this operating environment depend on the satellite configuration.

Urban satellite propagation is characterised by frequent blocking of the signal and multipath mostly due to buildings, and space stations (satellites) located at varying elevations and positions. The varying elevations and positions for the 3G Mobile System satellites depend on the satellite constellation.

4.1.2.11 Rural Satellite Environment (ITU-R M.1034, Sec.7.2.11)

The rural satellite environment encompasses outdoor propagation ranges with zone (or spotbeam) radius up to around100 to 300 km in rural areas. Low traffic requirements are expected in this environment.

The mobile earth stations may be moving with zero to aeronautical speeds (0-1,500 km/h), and the space stations (satellites) may be moving with speeds (relative to ground) from practically zero to satellite speeds (0-27 000 km/h). The range and the relative speed in this operating environment depend on the satellite configuration.

Rural satellite propagation is characterised by line-of-sight and occasional shadowing, and space stations (satellites) located at varying elevations and positions. The varying elevations and positions for the 3G Mobile System satellites depend on the satellite constellation.

It should be noted that for the purposes of this Recommendation the rural satellite environment includes aeronautical and maritime. In these cases there may be significant differences to the rural land environment due to terminal speeds and propagation effects (e.g. multipath).

4.1.2.12 Satellite Fixed-mounted Environment (ITU-R M.1034, Sec.7.2.12)

The satellite fixed-mounted environment encompasses outdoor propagation ranges with zone (or spotbeam) radius up to around 100 to 300 km with stationary (fixed) mobile stations. Low traffic requirements are expected in this environment.

The mobile earth stations are stationary, and the space stations (satellites) may be moving with speeds (relative to ground) from practically zero to satellite speed (0-27 000 km/h). The range and the relative speed in this operating environment depend on the satellite configuration.

The propagation in this fixed case is characterised by an optimised positioning of the mobile earth station, and possibly use of directive antennas, so that multipath and blocking possibly can be avoided to some extent. Depending on the satellite constellation, the base stations (satellites) may be located either in a fixed position or at varying elevations and positions.

4.1.2.13 Indoor Satellite Environment (ITU-R M.1034, Sec.7.2.13)

The indoor satellite environment encompasses outdoor propagation with an additional indoor component added to it, with zone (or spotbeam) radius up to around 100 to 200 km. The indoor satellite environment is a special and restrictive case, with a very limited set of application areas, mostly restricted to paging. Very low traffic requirements are expected in this environment.

The mobile earth stations may be moving with zero to pedestrian speeds (0-10 km/h), and the space stations (satellites) may be moving with speeds (relative to ground) from practically zero

to satellite speeds (0-27,000 km/h). The range and the relative speed in this operating environment depend on the satellite configuration.

The propagation in this case is characterised by an outdoor component which may be caused by blocking of the signal and multipath due to mountains, trees or buildings, with an additional indoor component requiring an additional margin of the order of 10-15 dB. The space stations (satellites) are located at varying elevations and positions. The varying elevations and positions for the 3G Mobile System satellites depend on the satellite constellation.

4.2 Radio Propagation Characteristics (ITU-R M.1034, Sec.8)

Radio propagation characteristics need to be determined in order to develop the system design for a 3G Mobile System. Radio propagation characteristics include:

– maximum transmission ranges,
– overall path loss prediction models,
– multipath delay spreads,
– slow fading statistics,
– fast fading statistics,
– maximum Doppler shifts.

Four different radio propagation environments have been identified: the indoor environment, the terrestrial outdoor environment, the outdoor to indoor environment and the satellite environment. Propagation models for these environments exist, or are being developed, and can be found in the P-Series of ITU-R Recommendations.

4.2.1 Indoor Environments (ITU-R M.1034, Sec.8.1)

The home, business and industrial indoor environments are characterised as follows:

Maximum transmission range: Typically below 100 m.

Overall path loss prediction models: Even though indoor propagation distances tend to be short, a line-of-sight (LOS) path between base and mobile stations can seldom be guaranteed due to the presence of walls, floors, furniture, etc. Therefore path losses are in general in excess of LOS path loss. This excess path loss is generally low in open industrial buildings, moderate in the home environment and stronger in the office environment. It can also be adequately modelled by means of wall and floor penetration losses. Leakage to surrounding outdoor or to neighbouring buildings is to be expected.

Multipath delay spreads: Typical indoor r.m.s. delay spreads range from several tens to several hundreds of nanoseconds. Worst case delay spreads occur typically in the absence of LOS path and/or when inter-building reflections are involved.

Slow fading characteristics: Obstructions of the LOS path give rise to substantial shadowing effects, particularly in the office environment.

Fast fading characteristics: Although fast fading is generally frequency selective, for narrow-band systems this fading can be regarded as flat. For high transmission bit rates (above 1 Mbit/s) the frequency selective nature must be considered.

Maximum Doppler shifts: Typically lower than 10 Hz since they are proportional to pedestrian speeds.

4.2.2 Terrestrial Outdoor Environments (ITU-R M.1034, Sec.8.2)

Terrestrial mobile systems generally employ a cellular architecture. Typical environments include rural, residential or suburban, and urban environments. Such environments are characterised as follows:

Maximum transmission range: Typically from 100 m in urban micro cells to 35 km in rural macro cells, and up to 100 km in fixed-mounted outdoor cells.

Overall path loss prediction models: The model developed by Okumura and Hata has found wide acceptance. However, for urban environments, where shadowing needs particular attention, the COST 231-Walfish-Ikegami model seems more appropriate. A more accurate path loss prediction can be achieved by taking edge diffraction and scattering into account. Rough path loss estimates can also be obtained using an inverse third to fourth power law.

Multipath delay spreads: Typical outdoor r.m.s. delay spreads range from 1 μs for rural and suburban areas to 2 μs for urban areas. However, longer and even much longer delay spreads occur when reflections from distant hills or distant high-rise buildings are involved.

Slow fading characteristics: Shadowing effects can be adequately modelled by a log-normal distribution. A standard deviation of 8 dB is often used by network designers.

Fast fading characteristics: Fast fading of the received signal envelope can be modelled by a Nakagami-*m* distribution in the general case, which degenerates to a Rayleigh distribution in the absence of specular paths. The Rice distribution also provides a very good fit. Fast fading is also generally frequency-selective in the outdoor environment.

Maximum Doppler shifts: Range from about 10 Hz for pedestrian users to about 1 kHz for high speed vehicular (e.g. train) users.

4.2.3 Outdoor to Indoor Environments (ITU-R M.1034, Sec.8.3)

This environment reflects the influence of building penetration on the terrestrial outdoor environment.

Maximum transmission range: Excess building attenuation reduces the maximum achievable range, relative to the terrestrial outdoor environment.

Overall path loss prediction models: Terrestrial outdoor models can be used with an additional loss called building penetration loss and defined as the difference in median signal levels between that measured immediately outside the building at 1.5 m above ground and that immediately inside the building at some reference level on the floor of interest. Median values between 10 and 18 dB with a standard deviation of about 7.5 dB are reported in the literature. An overall decrease of 1.9 dB per floor with increasing height is also reported. Signal loss within the building also increases when distance to the exterior wall increases. Measurements

indicate inverse distance power law exponents between 2 and 4. Typical car penetration losses between 8 and 10 dB have been measured at 1.9 GHz.

Multipath delay spreads: Since building attenuation tends to limit the maximum transmission range, large delay spreads are not expected.

Maximum Doppler shifts: Same as for the indoor environment with some paths showing higher Doppler shifts in the neighbourhood of freeways.

4.2.4 Satellite Environments (ITU-R M.1034, Sec.8.4)

Maximum transmission range: Varies from a minimum of approximately 700 km when using LEOs (Low-Earth orbit satellites) to about 36,000 km for GSOs (geostationary orbit satellites) and 47,000 km for HEOs (highly inclined elliptical orbit satellites).

Overall path loss prediction models: The presence of a direct path between the satellite and the mobile user is generally a mandatory requirement. However, this direct path can suffer from additional attenuation from shadowing due to foliage, buildings and other man-made structures. The level of additional attenuation tends to increase when the path length through the obstacles increases. This occurs mainly when the elevation angle decreases. Data on foliage attenuation at 1.6 and 2.5 GHz can be found in the literature and can be appropriately scaled in frequency. Additional attenuation is also introduced by ionospheric and tropospheric disturbances. The former are essentially Faraday rotation and amplitude scintillation while the latter only appear for elevation angles below 5.
It should be noted that propagation impairments apply differently to the land, maritime and aeronautical satellite environments.

Multipath delay spreads: r.m.s. delay spreads tend to be smaller than a few microseconds.

Slow fading characteristics: The lognormal distribution provides adequate fits for the amplitude variations of the direct path over a large area.

Fast fading characteristics: The overall received signal envelope statistics can be modelled by a Rice distribution.

Maximum Doppler shifts: When using GSOs, Doppler shifts are essentially determined by the satellite and user speeds, and ranges up to 2 kHz for land mobile and maritime, and up to 4 kHz for the aeronautical, satellite environments. When using LEOs, Doppler shifts are essentially determined by the satellite speed, and range up to several tens of kHz with Doppler accelerations up to 350 Hz/s.

4.3 Spectrum Considerations

Considerations on spectrum for a 3G Mobile System should take into account the following items:

- frequency bands allocated for the terrestrial and the satellite systems

- existing radio systems, e.g. frequency band and services of DECT, PCS, PHS, etc.
- duplex techniques. e.g. frequency division duplex (FDD) and time division duplex (TDD) techniques
- commonality on dual mode terminal feasibility for the terrestrial systems and the satellite systems
- harmonisation on the world-wide spectrum usage and frequency plan
- frequency allocation to the public and private applications
- frequency bandwidth to meet the 3G Mobile System services

In Japan, the spectrum to be used for a 3G Mobile System should assume the considerations of the MPT's study group report on next generation mobile communications systems compiled (Ref. MPT1).

5 Services

5.1 Service Categories

5.1.1 General Service Objectives

5.1.1.1 Requirements on Service Creation (M.816, sec.4.3)

3G Mobile System services are provided for the mass market but should be offered in a flexible way so that individual requirements can be met. This requires flexible service creation instead of rigidly specified individual services. Support for intersystem roaming will require access to and invocation of the users personalized services where these services are supported by the concerned radio operating environment and access system.

5.1.1.2 General Service Requirements (M.816, sec.4.4)

To provide validation and authentication procedures to facilitate billing and accounting (see ITU-T Recommendation X.509);

- to provide for additional levels of security for telecommunication services;
- to provide privacy of location of a roaming user when desired by the caller or calling party.

5.1.1.3 General Access Requirements (M.816, sec.4.5)

For access to the fixed networks : a 3G Mobile System may be either an adjunct to or an integral part of the PSTN/ISDN. Services offered in the PSTN/ISDN should, as far as possible, be offered to 3G Mobile System users;

- for international operation : a 3G Mobile System should allow international operation and automatic roaming of mobile users and stations to the extent practical or permitted;
- for maritime and aeronautical : a 3G Mobile System should allow operation in the maritime and aeronautical environment to the extent permitted by national and international regulatory authorities;
- for satellite system : a 3G Mobile System should allow operation either directly or indirectly via satellite.

For access to the other PLMN : a 3G Mobile System should have a interworking function, if needed;

- for inter-system operation : A 3G Mobile System should consider the ability to support multi-mode operation service between inter-systems including different generation system, i.e. a pre-IMT-2000 and a 3G Mobile System.

For access to Internet : a 3G Mobile System should have the ability to support internet protocol, addressing etc..

5.1.1.4 Support of User Identity Module (UIM) Functionality (M.816, sec.4.7)

Originating and terminating calls should require a UIM as physical device or as a functionality to be present in the mobile terminal, subject to legal constraints concerning the requirement for UIM functionality in order to place an emergency call.

[The capability to record user and terminal identities should be provided. Whether such recording capability is actually used and the information provided to emergency service authorities is subject to national regulations.]

5.1.1.5 Support of Fixed Network Services (M.816, sec.6)

A 3G Mobile System will interwork or be integrated with fixed networks such as PSTN, ISDN, B-ISDN and others.

5.1.1.5.1 PSTN (M.816, sec.6.1)

A 3G Mobile System should support PSTN services.

5.1.1.5.2 ISDN (M.816, sec.6.2)

The ISDN is a fixed network which provides digital highways, digital signaling channel(s), and associated services to users' terminals. ISDN is defined in the ITU-T I-Series of Recommendations.

A 3G Mobile System will operate in an era when ISDN will be widely available; ISDN will provide users with high quality speech and data connections and services. Since a 3G Mobile System has the objectives of matching the quality of the contemporary fixed network, then the quality reference will be that of the ISDN. In addition, commonality of the technical elements of a 3G Mobile System, for example, speech codec, RF components, etc., enables cost benefits to be passed on to network operators and users.

The ITU-R recommends that the design of 3G Mobile System be conducted such that the maximum compatibility possible is achieved with the ISDN (see Recommendation ITU-R M.687). However, considering spectrum limitations and efficient spectrum usage, it is recognized that the 3G Mobile System user may not in all cases have available the full extent and quality of ISDN services.

5.1.1.6 Support of IP-based Services

A 3G Mobile System should support IP (Internet Protocol) based services. The Internet Protocol is specifically limited in scope to provide the functions necessary to deliver a package of bits from a source to a destination over an interconnected system of networks. A 3G Mobile System should support those delivery of IP packet data. The Internet Protocol can capitalize on the services of its supporting networks to provide various types and qualities of service. The

IP-based services provide a number of multimedia and data applications to users via the Internet. It will be one of the major and basic services to be supported in a 3G Mobile System. Examples of applications are shown below:

- WWW
- E-mail
- FTP
- Telnet
- Chat

TCP or UDP will be applied as the transport protocol for the service. The required user bit rate depends on applications and contents. Therefore, it is in the wide range from voice band data modem bit rates to 2Mbit/s. Because Internet service is conventionally best effort one, the end-to-end delay is not critical but it is necessary to reduce command response time in order to realize comfortable user environment.

5.1.1.7 3G Mobile System Service Features (M.816, sec.7)

Three main service features have been identified from a user's perspective which from a part of or are supported by a 3G Mobile System:

- mobility services,
- interactive services,
- distribution services.

5.1.1.7.1 Mobility Services (M.816, sec.7.1)

Mobility services are those services which are directly related to mobility of the user including terminal mobility (see also UPT in section 5.3.3). A particular mobility service is the location service.

Location information can be provided to authorized users by a 3G Mobile System or to relevant authorities in cases of emergency calls or for vehicular traffic management. In order to protect the privacy of the user, the access to location information must be restricted to specific applications authorized by the customer and the administration concerned. The location information accuracy is subject to system limitation and user requirement.

5.1.1.7.2 Interactive Services (M.816, sec.7.2)

Interactive services for a 3G Mobile System are closely aligned to those defined by the ITU-T for fixed networks. These are separated into three categories, conversational services, messaging services, and retrieval and storage services.

- Conversational services are to provide the means for bi-directional dialogue communication with real-time end-to-end information transfer from user to user or between user and host (e.g. for data processing).

- Messaging services offer user-to-user communication between individual users via storage units with store-and-forward, mailbox and/or message handling (e.g. information editing, processing and conversation) functions.
- The retrieval and storage services can retrieve and/or store information in information centers.

5.1.1.7.3 Distribution Services (M.816, sec.7.3)

Distribution services provide a continuous flow of information which is distributed from a central source to an unlimited number of authorized receivers connected to the network. They include broadcast services. The user may or may not be able to control the presentation and the information may be broadcast to all receivers or addressed to one or more specific receivers.

5.1.1.8 Quality of Services (M.816, sec.4.6)

Quality of Service (QoS) is the subject of a separate Recommendations, ITU-R M.1079 (Speech and Voice-band Data Performance Requirements) and ITU-T G.174 (Transmission Performance Objectives for Terrestrial Digital Wireless System Using Portable Terminals to Access the PSTN) which give the detailed requirements.

The QoS offered over a 3G Mobile System should be closely comparable to the quality of the services achieved when using the contemporary fixed networks (e.g. PSTN/ISDN) alone.

5.1.1.8.1 General (F.115, sec.9.1)

Consideration will need to be given to maintaining QoS during handover between cells and to any implications in relation to cell size, frequency requirements, protocols, etc.

5.1.1.8.2 Speech Quality (F.115, sec.9.2)

The quality of speech services in a 3G Mobile System should be comparable to that of PSTN/ISDN. Speech services are sensitive to delay and this needs to be taken into consideration (see Recommendation G.114).

The quality of speech supported within a 3G Mobile System should be normally that recommended in the P-Series Recommendations. However, it is acknowledged that in some application where low bit rate coding is employed, some minimal degradation of speech quality may occur.

5.1.1.8.3 Quality of Service for Packet Transfer Mode Services

[TBD]

The quality of packet transfer mode services in a 3G Mobile System should be controlled by these four parameters;

- throughputs (user service rates),
- priority class (transmission delay),
- data reliability (residual error rates),
- packet length (division of packet).

The QoS specified by IETF for IP (RSVP; Resource ReSerVation Protocol specified in RFC2205) should be supported.

5.1.1.8.4 Selection of Quality Level

To enable the unrestricted selection of quality levels of services for any subscriber, in general quality levels will be decided by the service profile of the user and the result of service negotiation.

5.1.2 Bearer Capability

5.1.2.1 Overview

[TBD]

A 3G Mobile System should have a capability to provide interface involving only low layer function to transfer information and data between users or access points. It consists of circuit transfer mode bearer and packet. This capability also contains the following features and characteristics:

User bit rate : It defines the peak bit rate of user information transfer. Appropriate rate for each communication is chosen by user or the system in accordance with the application or condition. According to the request of application, a 3G Mobile System should be able to support multiple or variable rate.

Bit error rate : To provide suitable interface for user, a 3G Mobile System should keep certain required bit error rate.

Connection mode : There are two types, connection oriented and connectionless. It can be defined from a point of required procedure to establish and release the connection. In connection oriented mode, unique specified procedure should be done at establishment and release. In connectionless mode, user information is directly transferred without such procedure. A 3G Mobile System should support both connection mode.

Configuration of connection : There are three possible types of connection between users or access point, e.g. point-to-point, multipoint and broadcast. A 3G Mobile System should support those various configuration of the connection.

Symmetry : It means two categories. One is symmetry or asymmetry of user information volume in the case of bi-directional communication. In this case asymmetrical transfer rate is

adopted for each link. The other is uni-directional (one-way) communication. A 3G Mobile System should support both case.

Quality of Service negotiation :
It can be defined by three main parameter, user bit rate, bit error rate and delay. Some application may require significant set of these value. These parameter are negotiable in accordance with the application requirements and system conditions. This negotiation should be able to be carried out not only at establishment of the connection but during the communication.

5.1.2.2 Circuit Transfer Mode Bearer Capability

[TBD]

It provides dedicated continuous low layer interface for users. In this mode user bit rates up to 2Mbit/s should be supported. In addition, it should support high bit rate in several steps being adopted by existing ISDN (n times 64k bit/s), for example:

- 64 kbit/s unrestricted data (B)
- 384 kbit/s unrestricted data (H0)
- 1536 kbit/s unrestricted data (H11)
- 1920 kbit/s unrestricted data (H12)

5.1.2.3 Packet Transfer Mode Bearer Capability

[TBD]

In packet transfer mode there should be capabilities for requesting QoS per connection. Parallel connections with independent QoS should be available. Bit rates up to 2 Mbit/s (both for existing best effort service and for new QoS connections) should be possible.

5.1.3 Speech and Audio Services

Speech and Audio Services provided for a 3G mobile system are categorized into following four services; Telephony service, High Quality Speech service, High Quality Audio service and HiFi Audio broadcasting service. The definitions of these services are as follows. (Refer to the ANNEX 3 for the details.)

5.1.3.1 Telephony

Speech (3kHz) communications between 3G users and fixed wireline telephone service users or 1/2/3G PLMN users. The telephone service is a public telecommunication service primarily intended to exchange information by the form of speech, whereby users can communicate directly and temporarily between themselves in conversation mode. It should be provided in accordance with the International Telecommunication Regulations (Melbourne, 1988) and the relevant CCITT Recommendations (ITU-R M.816).

5.1.3.2 High Quality Speech

Speech (7kHz) communications via bi-directional and symmetric channel within 3G users or with fixed wireline users with equivalent or better quality than the audio quality of G.722.

5.1.3.3 High Quality Audio

On-demand based or broadcasting type communications between fixed centers. High Quality Audio service provides news or music to 3G users with equivalent or better quality than the AM (7kHz) or the FM (15kHz) radio.

5.1.3.4 Hi-Fi Audio broadcasting

Broadcasting type communications from fixed center. HiFi Audio broadcasting service provides music to 3G users with near CD (20kHz) or CD equivalent quality.

5.1.4 Video and Data Services

This section clarifies the definitions and requirements of video and data services to be provided in a 3G Mobile System. Those services can be supported by both IP-based network connection (Internet Access) and fixed network connection. Video and data services are categorized into five groups in this section. Among them, services related to video are emphasized because these are significant and promising services for a 3G Mobile System. The detailed QoS's and network parameters for video and data services are summarized and the backbone networks to be connected to a 3G Mobile System for these services are identified in Annex 4.

5.1.4.1 Video-Real Time, Bi-directional

This service is real time and bi-directional communications by means of video and voice, including multipoint conference functions. It is a key point to achieve the low end-to-end delay under a certain bit error rate. From the bit rate and video quality viewpoints, this service is categorized into two as follows.

Video Telephone/Conference: This service is defined as a cost effective video communication of which user bit rate should be the minimum of 16kbit/s. The video quality should be equivalent to MPEG4 or H.263+ and QCIF picture size. The speech quality is equivalent to telephone services to be provided by a 3G Mobile System. The allowable end-to-end delay is 150msec~400msec. The BER to be required for this service is not clearly identified so far, but three candidates 10^{-3}, 10^{-4}, and 10^{-6} are discussed. The bit error rate requirement should be subject to the further study, taking account of the effects on video quality by codec system error correction capability and delay.

High Quality Video Telephone/Conference: This service is similar to the above, but the minimum bit rate is higher, for example, 64kbit/s and the picture size is required to be more than QCIF. The required end-to-end delay, and BER are the same as the above.

5.1.4.2 Streamline Video

Streamline video is a quasi real time video service which is popular in Internet. Receiving video data from a network, video images are reproduced in on-line-mode without storage. Audio

services as well as video can be also provided by streamline schemes. There are two types of streamline video services to be identified as follows:

Video Broadcasting: Video and audio data, such as music and news, are distributed to many unspecified users or multicasted to specified users in streamline mode. These data are mostly transported in packet transfer mode and only the download channel path is required. The minimum download channel bit rate should be 16kbit/s for audio services and 32kbit/s for video services. The BER on a 3G Mobile System bearer to provide video broadcasting services is allowed to be 10^{-6} and/or 10^{-3}. The end-to-end delay is not critical due to broadcasting type services.

Video On Demand: Streamline video contents such as movies, news and video mails are selected and served by user's demands. Because this service is asymmetric, the download channel data bit rate should be larger than the upload channel one. For example, the download channel bit rate should be more than 32kbit/s for video services, but, the upload channel bit rate might be around 16kbit/s. In the case of use of TCP/IP, the end-to-end delay should be tolerable for TCP retransmission in order to avoid the degradation on download channel throughput. This on-demand video service is mainly provided by packet transfer modes.

5.1.4.3 Video and Data Real/Non-real Uploading Type

This is an asymmetric service which up-loading data volume is more than down-loading one. A typical service is to monitor remote places with video cameras controlled by the download channel signals. In some cases, still pictures are used. The user bit rate should be from kbit/s to 2Mbit/s for upload channel, and from 8 to 64kbit/s for download channel. The real time function is required for the download channel to control equipment at remote sites, but not for the upload channel.

5.1.4.4 Data-Real Time, Bi-directional

This is a data transmission service between a 3G Mobile System user and fixed network or other 3G Mobile System user. For this service, a real time characteristic is required and the data volume of uploading and downloading is almost the same. Typical services are virtual games, telemedicine, chat service, and etc. The required bit rate depends on the services and contents, in the range of 16kbit/s to 2Mbit/s. The service quality should be equivalent to that of fixed wireline services.

5.1.4.5 Data Application

In addition to services mainly using video mentioned above, there are many other services consisting of data, text, still pictures, and sounds, and their combinations. Such services are referred to as data applications in this section.

On Demand Download Service: There are many applications categorized into the On Demand Download Services, such as electric commerce, information on demand, digital library, mobile concierge, on-line banking, and etc. In general, the networks for these services need to provide higher capacity in download channel than in upload channel. The required user bit rate depends on the contents, and the delay requirement is not critical.

Broadcasting Service: This service is similar to a news on demand service, but header information of news is always multicasted in connectionless mode. Therefore, users can select updated header information easily, and then download the detailed contents. The required bit rate depends on the contents, so, in the range of 8kbit/s to 2Mbit/s. The end-to-end delay is not critical.

Navigation Service: This service provides map data and supplemental area information to vehicular users and/or pedestrian users. The required bit rate should be up to 384kbit/s, and the end-to-end response time for user's commands should be minimized if the navigation service supports interactive modes. In general, the download channel data bit rate is higher than the upload channel one. As an option, the service may be activated by oral commands for vehicular user's convenience.

5.1.5 Voice-band Data Service

Voice-band data communication services for a 3G Mobile System are enabled by using modem of which operation procedure and protocol are specified in the following recommendations or specifications in table 5-1:

Protocol support	Applicable recommendations/specifications
Data transmission	V90, X2, V.34+, V.34, VFC,V.33, V.32bis, V.32, V.23, V.22bis, V.22, V.21, V.8, Bell 212A, Bell 103
Data compression	MNP5, V42bis, MNP10
Error correction	MNP2-4, V.42LAPM, MNP10EC, ETC

Table 5-1 Recommendations or Specifications for Voice-Band Data Services

The above recommendations and specifications of modem which have been defined or are being studied by standardization bodies such as ITU, ETSI, ANSI, TIA, TTC are required to be considered in specification of Voice-band data communication services for a 3G Mobile System as option. In addition, regarding new protocol which has been not standardized yet, it is recommended to consider supporting the operation.

In order to provide enough capability for multimedia services in a 3G Mobile System, it should be considered to support high speed voice band data communication capability compatible with PSTN (e.g. 56kbit/s).

The voice-band data is to be implemented by the use of Adapter and Interworking Function (IWF). However for Wireless Local Loop (WLL) applications it may be necessary to have an optional 64 kbit/s PCM implementation.

5.1.6 Group 3 Facsimile Service

Group 3 facsimile service for a 3G Mobile System should have capability to support ITU-T T.30 protocol, also in the international calls.
The Group 3 facsimile is to be implemented by the use of Adapter and Interworking Function (IWF). However for Wireless Local Loop (WLL) applications it may be necessary to have an optional 64 kbit/s PCM implementation.

5.1.7 Supplementary Services

Supplementary services supported in the pre-3G mobile systems should be supported in a 3G mobile system, as far as possible. The possible supplementary services include the input from ISDN, PDC, IS-53, GSM and the requirements for FWA, are listed in Annex 5.

Supplementary services listed in Annex 5 are summarized as following categories.

(1) Number Identification Supplementary Services
(2) Call Offering Supplementary Services
(3) Call Completion Supplementary Services
(4) Multiparty Supplementary Services
(5) Community of Interest Supplementary Services
(6) Charging Supplementary Services
(7) Additional Information Transfer Supplementary Services
(8) Origination and Termination Restriction Supplementary Services
(9) Priority Services

(10) Security and Privacy Services
(11) Feature Control and Interrogation Services
(12) Smart Dialing Services
(13) Mobile Bearer Specific Services
(14) Operator Supplementary Services
(15) Multiple Subscriber Profile

5.1.8 Mobile-specific Services

5.1.8.1 Location service (M.816, <Sec.7.1.14>)

The provision of information to the calling or called party as to the location of the corresponding 3G Mobile System user. In order to protect the privacy of the 3G Mobile System user, access to location information must be restricted to specific applications authorized by the 3G Mobile System user and the administration concerned (see Appendix 1).

There are many applications that could utilize subscriber location service. One obvious example is the location of emergency calls, but there are many other applications. Some examples of applications based on location services are listed below.

Emergency service: Emergency service would identify the user's location to the appropriate service organization sending assistance.

Location based information service: Area information around the user's location, such as restaurant, sightseeing, hospital, pharmacy, weather forecast information, etc. The registered user can finish his check-in automatically when he enters the airport area.

Location sensitive billing: There may be an interest from operators, to base the charging on the geographic location of the subscriber. For instance, allowing cheaper calls from the subscribers residence.

Fleet management: Fleet management can be used by a transportation company to keep track of where each vehicle of the fleet is currently located.

.**Where are you**. **applications:** Keeping track of e.g. child, elderly, disabled person, employee, etc.

Tracking of valuable assets: Supervision of high security transports. This could be transportation between banks etc. This application could also be used to track down stolen terminals or any object that has a terminal attached to it, e.g. stolen cars.

Navigation: Indication of current position, navigation to the destination.

Real time traffic update: Offering a traffic information around his position such as traffic jam, road construction, accident, etc.

Location statistics for network planning: A way for operators to collect statistics about the usage of their network. This information could be used for improvements and tuning of the

network, e.g. whether to add micro cells.

Location statistics for dynamic network control: Similar as above with the difference that there might be parameters in the network that could be tuned in real time to improve the performance of the system.

5.1.8.2 Short Message Service

A 3G Mobile System is required to support Short Message Service and these connectionless services allow the exchange of messages of limited length (e.g. a few hundred characters) between a storage system and a mobile station, or between mobile stations in real time. It can be a point-to-point or point-to-multipoint service.

5.1.8.3 Paging Service

A 3G Mobile System should be able to provide paging service. The users can send not only a simple alert message (e.g. tone only) or some character message (e.g. numeric, alphanumeric or transparent data) but various information by data, voice, image or video. Occasionally, those information type is multiplexed. Therefore, it is in the wide range of 8kbit/s to 384kbit/s, depending on the service applications and contents. The required QoS is equivalent to the other data download services. This service is, in some cases, bi-directional communications between individual users via storage units i.e. paging center. It is necessary to consider an applicable interface between MS and paging center.

5.1.8.4 Specific Dispatch Services

a) Group call
A group call is a bi-directional point-to-multipoint communication between a calling and several called parties. All called parties must be previously defined and belong to the same closed user group. There is no control of called parties presence in communication. Late entry may be provided (see note).

b) Selective broadcast call
A selective broadcast call is a unidirectional point-to-multipoint communication between a calling party and several called parties. All called parties must be previously defined and belong to the same closed user group. There is defined and belong to the same closed parties presence in the communication. Late entry may be provided (see note).

c) Broadcast call
A broadcast call is a unidirectional point-to-multipoint communication between a calling party and all parties within a specified radio coverage area.

Note: The late entry facility provided for inclusion of a called party not reached at the establishment of the call. It requires that the point-to-multipoint communication existence be signed for the duration of the call.

5.2 Security and Privacy

The 3G Mobile System services provide the following features related to the user security and privacy:

- the protection of users from unresponsible bill caused by the fraud use of services;

- the protection of user and service profile from illegal disclosure to and manipulation by the third parties;
- the privacy of communications;
- the privacy of user locations.

The provision of the above features shall, as far as possible, be transparent to the users and require a minimum of user interactions on a per call basis.

5.3 User Mobility

5.3.1 Terminal Mobility

The terminal mobility provides the users with the ability to be in continuous motion whilst accessing and using telecommunication services and the network with the capability to keep track of the moving user terminal. This requires the telecommunication services to be available throughout the network coverage and ideally at all times.

5.3.2 User Mobility

The user mobility is conferred by the flexibility of access by users to telecommunication services which are available at any terminal, in such a way that the user gives its identity and related profiles by means of detachable UIM to the mobile terminal and/or network to be accessed, and may configure any one of these terminals, fixes or mobile, to meet its service requirements. The user mobility involves the network capability to locate a user with reference to a unique user identity (i.e. IMT-2000 number) for the purpose of addressing, routing and charging of calls.

5.3.3 Universal Personal Telecommunication (UPT) (M.816, Sec.5)

UPT is a service which allows a user to access through any suitably equipped terminal, regardless of the 3G Mobile System terminal or terminals for other networks, to a range of telecommunications services which are specific to the user requirements. UPT provides the personal mobility, which is equivalent to the user mobility when the mobility is bound within the a 3G Mobile System, as opposed to the terminal mobility provided by a 3G Mobile System. UPT involves the use of a unique personal identity, i.e. UPT number, for the purpose of access to the services. The details of UPT are defined in ITU-T Recommendation F.851.

A 3G Mobile System has the objective of supporting UPT and maintaining the UPT's common presentation to users.

5.4 Charging

System design should permit different charging and billing rates to be used in different networks.

5.5 Service Requirements for Phase 1

The Phase 1 standardization of a 3G Mobile System is targeted based on a two-step approach. Step 1 is defined as a set of bearer channel capabilities which include the circuit transfer mode bearer channels at up to 384 kbit/s and packet transfer mode bearer channel at 384 kbit/s for indoor and pedestrian environments as well as the circuit transfer mode bearer channels at up to 128 kbit/s and the packet transfer mode bearer channel at 144 kbit/s for vehicular environments. Standardization of Step 1 capabilities should be finalized at the first half of 1999 in order for these capabilities to be available for services in 2001.

Step 2 is defined as a set of bearer channel capabilities which include the circuit transfer mode bearer channel at up to approximately 1.5 Mbit/s (equivalent to 64 kbit/s times 23 channels) and the packet transfer mode bearer channel at 2Mbit/s for the indoor environments. Standardization of Step 2 capabilities should be targeted for 2002, provided that high level definitions such as the system architecture and major parameters should be available when the details of Step 1 capabilities are defined.

A 3G Mobile System shall be capable of supporting pre 3G services currently available in a manner transparent to the users of pre 3G services. In addition to these services, a 3G Mobile System should offer such services that can differentiate itself from the pre 3G services. Based on these considerations, the details of the following services shall be standardized at the time when Step 1 capabilities are determined, i.e. by the first half of 1999:

- Telephony
- High Quality Speech
- Video - Real Time, Bi-directional
- Voice-Band Data Service
- Group 3 Facsimile Service
- Supplementary Service (at least being supported by the existing 2G system)
- Location Services
- Short Message Service
- Paging Service
- Internet Access Services

It should be noted that the following service features shall be available to any of the services listed above:

- Security and Privacy
- User Mobility
- Charging

Other services listed below will also be able to be implemented using the Step 1 bearer capabilities. It is highly desirable that these services are standardized in the time frame of Step 1 standardization.

- High Quality Audio
- Hi-Fi Audio Broadcasting
- Streamline Video

- Video and Data Real / Non-real Uploading Type
- Data - Real Time, Bi-directional
- Specific Dispatch Services

It should be noted that the services listed above could be augmented by the availability of the Step 2 capabilities.

5.6 Services to be considered for later phases

It is important to incorporate emerging and new services requirements in the 3G Mobile System service portfolio as time goes by. One of the service areas that can be augmented in the later phases will be those that uses higher bit rate bearer capabilities becoming available in the wider range of operating environments.

Examples of such services are listed below:
- support of the high data rate needs of portable computing users, and
- support of enhanced multimedia communications requirements

,6 System Requirements

This section describes systems requirements for a 3G Mobile System.

6.1 Service accessibility, 6.2 User-related requirements, and 6.3 Operational requirements are discussed based on the 3G Mobile System radio operating environments and radio propagation characteristics defined and discussed in section 4.1 and 4.2.

6.1 Service Accessibility in Radio Operating Environments (ITU-R M.1034, Sec.9)

A 3G Mobile System will provide a wide range of services in a wide range of service and radio operating environments and to a wide range of mobile station types. However, the physical radio interface is a limiting factor, and not all services are practical for provision in all radio operating environments, nor would they be meaningful in all radio operating environments. It should be noted that the exact services to be provided in the various 3G Mobile System operating environments are national or operator-specific choices.

This section defines the service accessibility requirements for 3G Mobile System services across the various 3G Mobile System radio operating environments, based on limitations of the 3G Mobile System radio interface(s). The service accessibility requirements defined in this section thus serve as requirements for the 3G Mobile System radio interfaces.

6.1.1 Service Accessibility Parameters (ITU-R M.1034, Sec.9.1)

3G Mobile System services may be categorised in various ways, with various different parameters and attributes. The most relevant service parameters and attributes which may have an impact on the design of the 3G Mobile System radio interface(s) are the service information type and the user bit rate. A given information type may be associated with a range of services.

The following service information types have been identified for a 3G Mobile System:

– Speech
– Audio
– Data
– Text
– Image
– Video.

Each of these service information types may have several sub-types. For example, speech is normally associated with the telephony teleservice; telephony would be thus one of the speech sub-types. However, high quality telephony is currently being standardised and should be a sub-category. In a similar manner, audio could be of high quality or telephone quality, and for data, the information bit rate leads to several sub-types. The image and video types are also split into low- and high-resolution types.

6.1.2 Classification of Service Accessibility (ITU-R M.1034, Sec.9.2)

The accessibility of a 3G Mobile System service may be categorised in several ways, with various different parameters and attributes, including:

a) *Its cellular coverage*

The cellular coverage may depend on several factors like the system coverage and the radio coverage.

The system coverage may be:

– global service area,
– regional service area,
– national service area,
– limited service area.

The radio coverage may be:

– contiguous coverage,
– island coverage,
– spot coverage.

b) *Its support in operating environments*

The support of 3G Mobile System services in an operating environment refers to the technical capabilities of the radio interface(s) to support 3G Mobile System services in that operating environment, i.e. what that radio interface is primarily designed for. It should not restrict regulators or operators choosing appropriate services for the operating environments.

6.1.3 Service Accessibility Requirements (ITU-R M.1034, Sec.9.3)

6.1.3.1 System Coverage (ITU-R M.1034, Sec.9.3.1)

The 3G Mobile System coverage depends on national and operator specific choices, and on the eventual international compatibility. It is desirable to accomplish system coverage without placing significant design requirements on the 3G Mobile System radio interface(s).

6.1.3.2 Radio Coverage (ITU-R M.1034, Sec.9.3.2)

The radio coverage depends on national and operator specific choices, but may have some impact on the design on the 3G Mobile System radio interface(s) in terms of, for example, handover, roaming and location updating.

Radio coverage requirements are covered in Table A6-1 together with service information categories and operating environments, where the mapping is to service information categories rather than operating environments.

6.1.3.3 Support of Services in Operating Environments (ITU-R M.1034, Sec.9.3.3)

Provisional service accessibility requirements across 3G Mobile System operating environments for various 3G Mobile System service information types are given in Table A6-1. Also, radio coverage requirements are covered in this table, mapped on to service information types. Further study is required.

The eventual accessibility of 3G Mobile System services may depend on issues of a commercial or regulatory nature, e.g. on whether there is public or private access, whether or not there is competition in the service provision, etc. The service accessibility requirements given in Table A6-1 are, however, not intended to restrict the provision of 3G Mobile System services in any operating environments, but are only defined as a basis for the optimization of the design of the 3G Mobile System radio interface(s) and their characteristics.

The exact 3G Mobile System services or service categories of any kind to be provided in the various 3G Mobile System environments are to be decided by the 3G Mobile System service providers or operators.

6.2 User Related Requirements (ITU-R M.1034, Sec.10)

This sub-section includes requirements from the perspective of the end-user. Actual requirements for the radio interface(s) are contained in Recommendation ITU-R M.1079.

The detailed choice of 3G Mobile System services to be provided in any given area is a national or operator specific matter. However, the service capabilities for which the 3G Mobile System radio interface(s) shall be optimised are defined in this Volume.

The framework for services for a 3G Mobile System is defined in Recommendation ITU-R M.816, and the operational and service provisions for a 3G Mobile System are given in ITU-T Recommendation F.115. Further, the service accessibility requirements across 3G Mobile System radio operating environments are given in section 6.1 of this Volume.

6.2.1 Service Related Requirements (ITU-R M.1034, Sec.10.1)

6.2.1.1 Support of Multiple Services (ITU-R M.1034, Sec.10.1.1)

The 3G Mobile System radio interface(s) shall support this range of services with the service accessibility requirements given in section 6.1 of this Volume, and with sufficient capabilities to set up communication with any appropriate combination of these defined services with their defined qualities of service.

6.2.1.2 Flexible Service Platform (ITU-R M.1034, Sec.10.1.2)

The 3G Mobile System radio interface(s) shall be designed in a flexible manner so that new services can easily be implemented. The 3G Mobile System radio interface(s) shall support a flexible service creation and execution platform, allowing operator and user specific services to be easily created.

6.2.1.3 Variable User Bit Rates (ITU-R M.1034, Sec.10.1.3)

The 3G Mobile System radio interface(s) shall support variable user bit rate services. In addition, mechanisms for flexible user bit rate allocation according to user or system demand shall be supported by the 3G Mobile System radio interface(s). This applies to any 3G Mobile System radio operating environment, irrespective of the multiple access scheme used.

6.2.1.4 Voiceband Data (ITU-R M.1034, Sec.10.1.4)

Chapter 5 of this Volume specifies the services to be supported by a 3G Mobile System. Some of these services include voiceband data, which may have particular impact on the radio interface(s).

6.2.1.5 Support of Data Services (ITU-R M.1034, Sec.10.1.5)

The 3G Mobile System radio interface(s) shall support packet-switched data services as well as circuit-switched data services, irrespective of the 3G Mobile System radio operating environment or multiple access scheme used.

6.2.1.6 Support of G3 Facsimile Service

The 3G Mobile System radio interface(s) shall support the requirements for G3 facsimile service which are described in chapter 5 of this Volume.

6.2.1.7 Support of Internet Access Service

The 3G Mobile System radio interface(s) shall support Internet access service which is described in chapter 5 of this Volume.

6.2.1.8 Priority Access and The Emergency Services (ITU-R M.1034, Sec.10.1.6)

The 3G Mobile System radio interface(s) shall support the requirements for such services as are contained in chapter 5 of this Volume.

6.2.1.9 Simultaneous Use of Multiple Services (ITU-R M.1034, Sec.10.1.7)

The 3G Mobile System radio interface(s) shall support the simultaneous use of several different 3G Mobile System services by a single 3G Mobile System terminal.

6.2.1.10 Widespread Service (ITU-R M.1034, Sec.10.1.8)

Standardization of a minimum number of interfaces could be an essential requirement for widespread service to facilitate roaming to other service areas, other systems and other countries.

6.2.1.11 Dial Tone (ITU-R M.1034, Sec.10.1.9)

Although it is not desirable to provide dial tone across the air interface to conserve spectrum, it is desirable to provide an indication of network access similar to the PSTN (e.g. an indicator light or personal terminal generated tone).

6.2.2 Quality of Service Requirements (ITU-R M.1034, Sec.10.2)

6.2.2.1 Speech Quality

In section 5.1.3.1 and 5.1.3.2, the telephony and high quality speech services are defined.

The quality of the speech shall be comparable to the fixed network, for users of different age, sex and language, according to the requirements described in section 7.1 in ITU-R Recommendation M.1079 (see also ITU-T Recommendation G.174).

The telephony speech quality in a connection in a 3G Mobile System involving two radio links, under the error conditions defined by the current 3G Mobile System error model, together with any necessary transcoding shall not be degraded more than 0.5 MOS compared with error free G.726 at 32 kbit/s (see Recommendation ITU-R M.1079, section 7.3.1 Speech quality requirements). While the telephony speech quality in a connection in a 3G Mobile System involving one radio link, under the error conditions defined by the current 3G Mobile System error model, together with any necessary transcoding shall not be degraded more than 0.2 MOS compared with error free G.726 at 32 kbit/s.

3G Mobile System environments are expected to result in a higher level of background acoustic noise than with wireline, for example from road traffic, railway and bus station concourses, etc. The speech codec should therefore be robust to such background acoustic noise. The speech codec shall also be robust to the presence of other talkers in the background. The telephony speech quality in 3G Mobile System under such background acoustic noise conditions shall be equivalent to that of G.726 at 32 kbit/s.

The telephony speech quality shall be better than or at least equal to today's existing codecs used in 2G Mobile Systems (e.g. GSM-EFR, IS-95-EVRC), under three conditions (i.e. two radio links, one radio link, and with background acoustic noise).

Spectrum allocation and capacity requirements will determine channel bandwidth and codec bit rates used to achieve desired voice quality.

6.2.2.2 Speech Quality Maintenance Techniques (ITU-R M.1034, Sec.10.2.2)

Speech quality maintenance techniques, which maintain a subjectively acceptable speech quality to the users in case of temporary radio channel outages, shall be facilitated by the design of the 3G Mobile System radio interface(s), irrespective of the 3G Mobile System radio operating environment.

6.2.2.3 Speech Delay (ITU-R M.1034, Sec.10.2.3)

With the widespread use of wireless systems in the public network, the overall transmission performance experienced by users will be largely influenced by the performance of wireless systems. The 3G Mobile System radio interface(s) should be optimised to minimize delays, which implies careful design of any RF frame structure and of processing for voice coding, modulation, demodulation and in the base station.

The design objective for one way delay within the 3G Mobile System network should not be greater than 80 ms. The objective for the speech codec delay time is set no greater than 45 ms which includes all the necessary delay elements for speech codec, i.e. algorithm delay and processing delay (both encoding and decoding).

6.2.2.4 Data Quality (ITU-R M.1034, Sec.10.2.4)

Requirements for data performance on the interconnection with PSTN are in ITU-T Recommendation G.174. Data performance on the interconnection with ISDN should be maintained properly.

6.2.2.5 Bit-count Integrity (ITU-R M.1034, Sec.10.2.5)

Bit-count integrity should be maintained across link transfers and periods of multipath fading. This is important for synchronous data services and many encryption techniques.

6.2.3 Cost and Complexity-related Requirements (ITU-R M.1034, Sec.10.4)

A low cost/complexity goal could be facilitated by a minimum number of discrete standards for a 3G Mobile System. This could rapidly provide the greatest penetration and coverage area commensurate with optimal cost, complexity and use of spectral resources. Low cost/complexity is clearly important for a widely acceptable portable telephone service.

The 3G Mobile System radio interface(s) shall be designed in such a way that the total cost of a 3G Mobile System mobile station, when mature in technology and in the appropriate system

application area, shall not be greater than the comparable mobile stations for the corresponding second generation systems. Preferably, the cost should be significantly lower.

6.2.4 Hand-portable Viability Requirements (ITU-R M.1034, Sec.10.5)

Hand-portable 3G Mobile System terminals are expected to be widely used. Some factors that determine hand-portable viability are size, weight, and operating time. The components that contribute to the size of the hand-portable terminal include: power supply (including battery), antenna, and microelectronics.

The following should be considered when assessing hand-portable viability:

- cost,
- effective radiated power,
- the power consumed by the required signal processing hardware,
- the possibility of exploitation of voice activity and/or power control to reduce average transmitted power,
- the impact of signal processing complexity on the size of the microelectronics,
- size and weight,
- ASIC and DSP implementation,
- antenna technology,
- battery technology,
- multi-mode considerations.

Power drain is an important concern because it affects the size of the battery for a specified operating time. Battery saving techniques for 3G Mobile System mobile stations shall be facilitated by the design of the 3G Mobile System radio interface(s), irrespective of the 3G Mobile System radio operating environment.

6.2.5 Safety and Electromagnetic related Requirements (ITU-R M.1034, Sec.10.6)

6.2.5.1 Safety Requirements (ITU-R M.1034, Sec.10.6.1)

It is to be anticipated that, before 3G Mobile System services commence, internationally agreed conditions for limits on thermal health hazards will be established. However, the non-thermal health hazards are also under study especially where pulsed transmissions are investigated. 3G Mobile System equipment shall meet the requirements of the then current relevant international safety requirements and legislation.

In particular, in determining the radio link budget for the 3G Mobile System mobile station, the maximum power into the antenna and the antenna gain must be such that the user of the apparatus is not subjected to RF radiation in excess of recommended safety limits. This is of particular importance for hand-portable mobile stations where the antenna will be close to the head and eyes of the user.

The perceptions of the general public regarding issues of thermal and non-thermal health hazards are recognised, since they could have an impact on 3G Mobile System service commencement.

6.2.5.2 Electromagnetic Compatibility (ITU-R M.1034, Sec.10.6.2)

The 3G Mobile System radio interface(s) shall be in accordance with appropriate EMC regulations. In the design of the 3G Mobile System radio interface(s), EMC performance shall be evaluated.

6.3 Operational Requirements (ITU-R M.1034, Sec.11)

The operational scenario for a 3G Mobile System is very complex. This section defines requirements on the 3G Mobile System radio interface(s), considering this complex operational scenario. The section also defines functional and performance requirements of the 3G Mobile System radio interface(s) for the operation of the system.

The operational requirements in this section are to be used for the initial design of the 3G Mobile System radio interface(s), and are not to be seen as final system requirements for a 3G Mobile System when put in operation. Further, there may be a range of additional more system-oriented operational requirements on a 3G Mobile System not covered in this section, which only includes operational requirements on the radio interface(s) of a 3G Mobile System. The operational requirements given in this section may constrain the physical 3G Mobile System radio interface(s) as well as the signalling mechanisms of the 3G Mobile System radio interface(s).

6.3.1 Scenario Requirements (ITU-R M.1034, Sec.11.1)

The operational scenario for a 3G Mobile System includes international operation across various 3G Mobile System radio operating environments, operation across multiple 3G Mobile System operators and multiple types of 3G Mobile System operators, operation over a terrestrial component and a satellite component, and across different regulatory scenarios. Further, a 3G Mobile System will support a range of different mobile station types and a variety of services with a range of bit rates. This section gives scenario requirements on the 3G Mobile System radio interface(s).

6.3.1.1 Support of Multiple Radio Operating Environments (ITU-R M.1034, Sec.11.1.1)

The radio operating environments for 3G Mobile System are defined in section 4.1 of this Volume. This includes a terrestrial and a satellite mode of delivery. The 3G Mobile System radio interface(s) shall support all of these radio operating environments.

6.3.1.2 Support of Multiple 3G Mobile System Operators

The 3G Mobile System radio interface(s) shall support various types of 3G Mobile System operators, and service by more than one 3G Mobile System operator of the same type in any given area.

The 3G Mobile System types of operators are generally regulatory and national matters. However, from a technical perspective, the 3G Mobile System radio interface(s) shall at least support the following types of 3G Mobile System operators:

a) Public 3G Mobile System operators

Uniquely defined public operators, with wide-area networks generally available to any roaming user.

[b) Private 3G Mobile System operators

Defined private operators, with local area networks generally available only to closed user groups. These operators would typically be private companies offering services to their own employees. They could in principle be unlimited in numbers, and would typically be uncoordinated.]

[c) Residential 3G Mobile System operators

These are residential users defined by a user identity rather than an operator identity, but may be regarded as residential 3G Mobile System operators. These operators would generally provide service only to one or a few residential users associated with a main residential user (the residential 3G Mobile System operator).]

The 3G Mobile System radio interface(s) shall also support logically different terrestrial 3G Mobile System operators and satellite 3G Mobile System operators.

6.3.1.3 Support of Multiple Equipment Vendors (ITU-R M.1034, Sec.11.1.3)

The 3G Mobile System radio interface(s) shall support the possibility of using different equipment vendors for the user equipment market as well as the fixed infrastructure market.

6.3.1.4 Support of Multiple Mobile Station Types (ITU-R M.1034, Sec.11.1.4)

The detailed design of 3G Mobile System mobile stations is a matter for 3G Mobile System mobile station manufacturers. However, some mobile station issues still need to be categorised from a system perspective, and some 3G Mobile System mobile station types are therefore defined in Recommendation ITU-R M.687.

These include 3G Mobile System mobile stations with different output power classes, mobile stations with different service access configurations or different access capabilities, and even

mobile base stations. The 3G Mobile System radio interface(s) shall support this range of 3G Mobile System mobile station types.

6.3.2 Functional Requirements (ITU-R M.1034, Sec.11.2)

This section gives functional requirements of the 3G Mobile System radio interface(s). These are all subject to service capabilities chosen for implementation in the 3G Mobile System mobile station by the 3G Mobile System mobile station manufacturers, and the 3G Mobile System network operator's choice of network and services in a given geographical area. If the relevant service capabilities are implemented in the networks and in the mobile stations, however, these requirements shall apply.

6.3.2.1 Structural Complexity (ITU-R M.1034, Sec.11.2.1)

6.3.2.1.1 System Complexity (ITU-R M.1034, Sec.11.2.1.1)

There may be significant advantages in maximising the commonality between the radio interfaces for different 3G Mobile System radio operating environments and system application areas. Such advantages include economy of scale, greater markets and thus lower costs, greater competition and thus lower prices, and better service availability for mobile users.

The 3G Mobile System radio interface(s) shall be designed with the aim of minimising the structural complexity of the total 3G Mobile System radio sub-system. There may be more than one 3G Mobile System radio interface. However, the number of different 3G Mobile System radio interfaces shall be minimised, and the commonality between the different 3G Mobile System radio interfaces shall be maximised.

6.3.2.1.2 Mobile Station Complexity (ITU-R M.1034, Sec.11.2.1.2)

The 3G Mobile System radio interface(s) shall facilitate easy manufacturing of 3G Mobile System mobile stations which support all 3G Mobile System radio operating environments, including the satellite as well as the terrestrial mode of delivery and whether public, [private] or [residential] 3G Mobile System networks.

6.3.2.2 Roaming (ITU-R M.1034, Sec.11.2.2)

6.3.2.2.1 General Support (ITU-R M.1034, Sec.11.2.2.1)

The standardised 3G Mobile System radio interface(s) shall have the capability to support roaming from any 3G Mobile System radio operating environment to any 3G Mobile System radio operating environment, irrespective of the physical radio interfaces for these. This

includes also roaming capabilities between different types of 3G Mobile System operators, whether public, [private] or [residential], or whether terrestrial or satellite.

The support of this feature in 3G Mobile System mobile stations will depend on the service capabilities of the mobile station, which are up to mobile station manufacturers, and on administrative inter-operator agreements on the network side, which may also imply subscription restrictions.

In order to be able to adapt to changes of operational environments and to provide technical roaming capabilities between different 3G Mobile System radio operating environments and between different types of 3G Mobile System operators, the 3G Mobile System radio interface(s) shall have the capability to identify networks and their structure, and for the 3G Mobile System mobile stations to detect and understand this scenario.

6.3.2.2.2 Physical Radio Interface Compatibility (ITU-R M.1034, 11.2.2.2)

Irrespective of the eventual choice(s) of physical radio interface(s) in the various 3G Mobile System radio operating environments, the design of the physical 3G Mobile System radio interface(s) shall facilitate roaming capabilities between all 3G Mobile System radio operating environments, whether satellite or terrestrial mode of delivery.

6.3.2.3 Handover (ITU-R M.1034, Sec.11.2.3)

The services provided to a 3G Mobile System user shall in principle be unchanged by handover and the qualities of service provided to a 3G Mobile System user shall in principle be maintained or improved.

6.3.2.3.1 General Support (ITU-R M.1034, Sec.11.2.3.1)

The standardised 3G Mobile System radio interface(s) shall, for a given service, have the capability to support handover from any 3G Mobile System radio operating environment to any 3G Mobile System radio operating environment, irrespective of the physical radio interfaces for these. This includes also a handover capability between different types of 3G Mobile System operators, whether public, [private] or [residential], or whether terrestrial or satellite.

The support of this feature in the mobile stations will depend on the service capabilities of the mobile station, which are up to mobile station manufacturers, on the network implementation of a service in a geographical area, and on administrative inter-operator agreements, which may also imply subscription restrictions.

6.3.2.3.2 Physical Radio Interface Compatibility (ITU-R M.1034, Sec.11.2.3.2)

Irrespective of the eventual choice(s) of physical radio interface(s) in the various 3G Mobile System radio operating environments, the design of the physical 3G Mobile System radio interface(s) shall facilitate handover capabilities between all 3G Mobile System radio operating environments, whether satellite or terrestrial mode of delivery.

6.3.2.3.3 Types of Handover (ITU-R M.1034, Sec.11.2.3.3)

The 3G Mobile System radio interface(s) shall support handover within a cell (intra-cell handover) as well as handover between cells (inter-cell handover).

The 3G Mobile System radio interface(s) shall also support multi-bearer handovers and radio originated as well as network originated handovers, as applicable to the 3G Mobile System network types.

6.3.2.3.4 Seamless Handover (ITU-R M.1034, Sec.11.2.3.4)

In a 3G Mobile System, the goal is to have an end-to-end quality of service which is comparable to that of the fixed networks. The 3G Mobile System radio interface(s) shall be designed to the greatest extent practicable such that the execution of handover is unnoticeable to the end users (seamless handover), irrespective of 3G Mobile System radio operating environments.

Every effort shall be made to accommodate this requirement of maintaining the quality of service during handover, including the possible momentary use of more than one radio channel. However, the design of the handover procedures over the 3G Mobile System radio interface(s) shall be such that execution of handover does not significantly decrease the system capacity.

6.3.2.3.5 Signalling Load of Handover (ITU-R M.1034, Sec.11.2.3.5)

The 3G Mobile System radio interface(s) shall be designed such that the signalling procedure required to execute handover is as short (quick) as possible. This is necessary in order to accommodate very small cells, or to accommodate high-speed mobile stations at cell boundaries. The 3G Mobile System radio interface(s) shall be designed such that the signalling load of handover shall be kept to a minimum.

6.3.2.4 Need for Inter-working

A 3G Mobile System will support a variety of services with a range of bit rates, including a range of data services. A 3G Mobile System will thus provide access to various circuit-switched and packet-switched data networks including Internet.

The 3G Mobile System radio interface(s) shall be designed in such a way that the need for specific inter-working functions in order to inter-work with various fixed networks, in particular data networks, is minimised.

6.3.2.5 Radio Network Deployment

6.3.2.5.1 Cell Size Flexibility (ITU-R M.1034, Sec.11.2.5.1)

The 3G Mobile System radio interface(s) shall support a range of cell sizes. The detailed definitions of these 3G Mobile System cell types are given in Recommendation ITU-R M.1035.

The 3G Mobile System radio interface(s) shall be designed in such a way that several of these cell types can be used simultaneously in the same geographical area (e.g. as umbrella cells). The 3G Mobile System radio interface(s) shall also support the use of several cells of the same type in the same geographical area (e.g. from different network operators).

6.3.2.5.2 Cell Location Flexibility (ITU-R M.1034, Sec.11.2.5.2)

The 3G Mobile System radio interface(s) shall be flexible with respect to the exact location of cell sites, such that significant system or capacity impairments due to non-ideal site locations are not risked.

6.3.2.5.3 Use of Repeaters

The 3G Mobile System radio interface(s) shall support the use of repeaters, in order to extend the radio coverage in a simple manner, e.g. in rural areas where the users are either too far away or too obstructed by terrain to communicate directly with a given base station.

A number of repeaters may have to be connected in tandem in specific cases. This may require extraordinary mechanisms, and lower end-to-end quality of service. The radio channel performance requirements defined in Recommendation ITU-R M.1079 apply to a single radio link.

6.3.2.5.4 Multi-operator Aspects (ITU-R M.1034, Sec.11.2.5.4)

The 3G Mobile System radio interface(s) shall facilitate the coexistence of multiple 3G Mobile System operators in the same geographical area. This may impose restrictions on each operator’s individual freedom in network planning.

6.3.2.5.5 Synchronization (ITU-R M.1034, Sec.11.2.5.5)

Time synchronization between different 3G Mobile System networks should not be a mandatory requirement.

6.3.2.5.6 Low Capacity Roll-out Flexibility (ITU-R M.1034, Sec.11.2.5.6)

The 3G Mobile System radio interface(s) shall facilitate minimum network installations in areas where little capacity is needed (e.g. in rural areas). Further, this low capacity roll-out shall facilitate band sharing with other (non-3G Mobile System) services.

6.3.2.5.7 Requirement for Fixed Wireless Access

The requirement for the user of Fixed Wireless Access (FWA) system is described in chapter 9 of this Volume.

6.3.2.6 Radio Network Management (ITU-R M.1034, Sec.11.2.6)

6.3.2.6.1 Frequency Planning and Coordination (ITU-R M.1034, Sec.11.2.6.1)

The 3G Mobile System radio interface(s) shall require a minimum of frequency planning and necessary inter-network coordination for operation of a single 3G Mobile System operator's network.

6.3.2.6.2 Cell Configuration and Management (ITU-R M.1034, Sec.11.2.6.2)

The 3G Mobile System radio interface(s) shall be designed in such a way that a minimum of operations for configuring or reconfiguring cells is required. It shall be simple to:

- take single channels out of service,
- install new channels in the cell,
- temporarily take the whole cell out of service,
- change the frequencies/channels in the cell,
- carry out tests of the cell,
- carry out maintenance on some channels in the cell, while leaving others in service,
- etc.

6.3.2.6.3 Traffic Adaptability (ITU-R M.1034, Sec.11.2.6.3)

The 3G Mobile System radio interface(s) shall support simple mechanisms to adapt to varying traffic needs, irrespective of a 3G Mobile System radio operating environment.

6.3.2.6.4 Capacity/Quality Control (ITU-R M.1034, Sec.11.2.6.4)

In specific cases, a 3G Mobile System operator may wish to increase the capacity of his network temporarily, e.g. during peak traffic hours or during special events.

The 3G Mobile System radio interface(s) shall support simple mechanisms to adapt and control the capacity and quality of service according to varying traffic needs, irrespective of the 3G Mobile System radio operating environment.

6.3.2.6.5 Channel Allocation Flexibility (ITU-R M.1034, Sec.11.2.6.5)

The 3G Mobile System radio interface(s) shall be designed in such a way that the allocation of channels within and between cells allows flexibility for handling varying services with a range of different, and possibly varying, bit rates in a spectrum efficient manner. This applies to all 3G Mobile System radio operating environments.

6.3.2.7 Radio Network Evolution (ITU-R M.1034, Sec.11.2.7)

6.3.2.7.1 Cell Expansions (ITU-R M.1034, Sec.11.2.7.1)

The 3G Mobile System radio interface(s) shall require a minimum of planning and operations in order to install new cells.

6.3.2.7.2 Use of Capacity Improvement Techniques (ITU-R M.1034, Sec.11.2.7.2)

The 3G Mobile System radio interface(s) shall facilitate the implementation and use of appropriate capacity improvement techniques, if applicable, in the various 3G Mobile System radio operating environments.

It is desirable that the appropriate capacity improvement techniques can be implemented in the initial radio interface(s) or be easily added to an existing 3G Mobile System radio interface.

It is desirable that the 3G Mobile System radio interface(s) does not depend on the implementation of these techniques, but that they are capacity improvement options. It is desirable that they do not significantly add complexity or cost to the infrastructure or mobile stations.

6.3.2.7.3 Implementation of New Services (ITU-R M.1034, Sec.11.2.7.3)

The 3G Mobile System radio interface(s) shall be designed in a flexible manner so that new services can easily be implemented at later dates.

In addition, the 3G Mobile System radio interface(s) shall be designed in such a way that a given service, and a given quality of service, can later be implemented in a more efficient manner (e.g. in a more spectrum efficient manner requiring lower channel bit rates).

6.3.2.7.4 Phased Implementations and Backwards Compatibility (ITU-R M.1034, Sec.11.2.7.4)

The 3G Mobile System radio interface(s) shall be designed in a flexible manner so that a 3G Mobile System can be implemented in phases with increased functionality. The 3G Mobile System radio interface(s) shall allow the maximum possible backwards compatibility to earlier phases, when new phases are implemented, and with minimal impact on earlier-phase mobile stations.

6.3.2.8 Spectrum Usage and Management (ITU-R M.1034, Sec.11.2.8)

6.3.2.8.1 Frequency Sharing with Other Services (ITU-R M.1034, Sec.11.2.8.1)

Depending on national frequency allocations, a 3G Mobile System may have to coexist and share the 3G Mobile System identified frequency band with other (non-3G Mobile System) services. The detailed frequencies for band sharing may vary from country to country.

The 3G Mobile System radio interface(s) shall support such band sharing with maximum flexibility. See also Recommendation ITU-R M.1036.

6.3.2.8.2 Efficient Spectrum Sharing between Operators (ITU-R M.1034, Sec.11.2.8.2)

In a 3G Mobile System, there may be several competing operators in a given geographical area. In addition, there may be several different types of 3G Mobile System operators operating in the same geographical area.

The 3G Mobile System radio interface(s) shall support efficient and flexible spectrum sharing between different 3G Mobile System operators. See also Recommendation ITU-R M.1036.

6.3.2.8.3 Power/Interference Control (ITU-R M.1034, Sec.11.2.8.3)

3G Mobile System mobile terminals shall, e.g. after power on, wait with their first transmission until they have received a valid signal from the network.
The 3G Mobile System radio interface(s) shall support mechanisms for minimising the power (and interference) transmitted by the 3G Mobile System mobile stations and base stations at any time, irrespective of the 3G Mobile System radio operating environment.

6.3.2.9 Radio Range and Cell Sizes (ITU-R M.1034, Sec.11.2.9)

More detailed descriptions of the 3G Mobile System cell types are given in Recommendation ITU-R M.1035. These cell types may have various sizes depending on the needs of the 3G Mobile System operators in different geographical areas.

The requirements on the 3G Mobile System radio interfaces from the various cell types may be generalised as follows:

- the cell types are generally related to the operating environments, but not uniquely;
- for indoor operating environments, a small range of cell sizes should be supported. However, an optimised indoor radio interface, if any, should be optimised for small to very small cells;
- for outdoor operating environments, all types of cells should be supported. However, an optimised terrestrial outdoor radio interface, if any, should be optimised for moderate to large size cells;
- for satellite environments, very large cells should obviously be supported.

For the most restrictive 3G Mobile System operating environments, the 3G Mobile System radio interface shall support cell sizes as small as 10 m in radius.

It should also be possible to accommodate terrestrial cells with coverage over very long ranges.

6.3.2.10 Diversity Techniques (ITU-R M.1034, Sec.11.2.10)

The design of the 3G Mobile System radio interface(s) shall facilitate the use of appropriate diversity techniques for improved quality or capacity, as appropriate to the 3G Mobile System radio operating environment.

However, the 3G Mobile System radio interface(s) shall, if possible, not depend on such techniques if they significantly add complexity or cost to the infrastructure or mobile stations.

6.3.2.11 Position Location Identification

A 3G Mobile System should be designed as objective to identify the location of a Mobile Station within a radius of no more than 125 meters in 67 percent of all cases. The degree of an accuracy will be calculated through use of Root Mean Square methodology.

The position measuring algorithm such as AOA (Angle of Arrival), TOA (Time of Arrival), TDOA (Time Difference of Arrival), etc. are not required to be standardized uniquely at this time, because improvements of technologies in this field are rapidly achieved to realize accurate positioning measurements and much higher quality of location services in future.

The use of MS for making emergency call to the police without a valued UIM should be studied.

In order to support various location services and allow to provide those services by service providers, it is required to specify the related interface reference point and general data format of coordinates. To protect a user privacy against an illegal user, applicable authentication and encryption scheme should be adopted at inter-system exchange of those location data.

In order to protect the privacy of a 3G Mobile System user, access to location information must be restricted to specific applications authorized by the 3G Mobile System user and the administration concerned.

For more information, refer to Appendix 1.

6.3.2.12 Operational Flexibility

The 3G Mobile System radio interface(s) shall be designed in such a way that operational flexibility is maximised. Operational flexibility may include modification of operational data in the mobile station via the radio interface described below;

- Over the Air Service Provisioning (IS-53) :
  The over the air service provisioning feature allows a potential service subscriber to activate (i.e., become authorized for) new service without the intervention of a third party (e.g., authorized dealers). The feature consists of over-the-air programming of certain mobile station indicators and electronic key agreement for secure transfer of the A-key to authorize telecommunication services with a specific service provider.
- Network Based Mobile Unit Software Download (IS-53) :
- Enable new services and applications to be delivered to subscribers via mobile unit;
- Provide capabilities and functions that complement existing services to simplify their use;
- Extend the functionality of mobile units to add value for customers without significantly affecting the weight, size, cost and battery life of these devices;
- provide carriers with a mechanism to activate and configure mobile units.

Implementation of this requirement in mobile stations is subject to the capabilities of the mobile stations.

6.3.2.13 Reconnection Procedure

It is desirable that 3G Mobile System has a capability to support a reconnection procedure in the case of dropped calls. The ability of this function may be limited due to the environment or availability of radio resource (i.e. type of bearer channel, traffic condition and etc.).

6.3.2.14 Risk (ITU-R M.1034, Sec.11.2.12)

6.3.2.14.1 Development and Implementation Risk (ITU-R M.1034, Sec.11.2.12.1)

The 3G Mobile System radio interface(s) shall be designed in such a way that the risk in development and implementation of the radio interface technology is kept at an acceptable level. This applies in particular to the implementation of the technology in 3G Mobile System mobile stations with a high degree of integration.

6.3.2.14.2 Operational Risk (ITU-R M.1034, Sec.11.2.12.2)

The 3G Mobile System radio interface(s) shall be designed in such a way that the impact of malfunctions in the fixed infrastructure creates the minimum loss of service for the 3G Mobile System users handled by that base station or any neighbouring base stations. The impact of

faulty 3G Mobile System mobile stations or any other interfering equipment should also be minimised. Situations to consider in this respect include:

- loss of inter-base station synchronization, if any,
- loss of a base station carrier,
- interference from other services in the same band, if any,
- interference from services in adjacent bands,
- interference from uncoordinated 3G Mobile System operators,
- faulty mobile stations transmitting with full power,
- etc.

6.3.3 Performance Requirements (ITU-R M.1034, Sec.11.3)

System oriented performance requirements for a 3G Mobile System are given in Recommendation ITU-R M.1079. These requirements are related to end-to-end quality of service issues, and include subjective quality related issues, objective digital error ratios, as well as timing and delay constraints, reliability figures and service access probabilities. The 3G Mobile System radio interface(s) shall support these requirements, whether in the physical radio interface performance or in the signalling protocols to achieve service.

The performance requirements given in this section are performance requirements with direct impact on the design of the radio interface(s), and may not have any direct relation to end-to-end quality of service issues. There may, however, be an indirect relation in some cases.

6.3.3.1 Resistance to Multipath Effects (ITU-R M.1034, Sec.11.3.1)

Given the physical environments for a 3G Mobile System network, the network must be able to cope with a certain amount of multipath effects. The 3G Mobile System radio interface(s) shall generally support operation in the presence of the multipath effects experienced in the various 3G Mobile System radio operating environments defined in section 4.1 of this Volume. The radio propagation characteristics in these environments are detailed in section 4.2.

6.3.3.2 Support of Moving Vehicles (ITU-R M.1034, Sec.11.3.2)

The 3G Mobile System radio operating environments are defined in section 4.1. The 3G Mobile System radio interface(s) shall support operation at appropriate vehicle speeds for each 3G Mobile System radio operating environment. These include vehicle speeds ranging from 0 to 500 km/h for terrestrial applications and to 1 500 km/h for aeronautical applications.

6.3.3.3 Radio Channel Performance (ITU-R M.1034, Sec.11.3.3)

Radio channel performance requirements are given in Recommendation ITU-R M.1079, based on a set of end-to-end quality of service objectives for the 3G Mobile System defined services.

Each 3G Mobile System service is defined with one or several end-to-end quality of service objectives, and the various radio channels to be defined are given performance requirements based on these.

The radio channel performance parameters can be specified as acceptable bit/frame error ratios (FERs/BERs) for given service qualities and given service access probabilities.

The radio channel performance for the 3G Mobile System radio interface(s) is no means for comparison. It is fixed at the radio channel performance levels given in Recommendation ITU-R M.1079, and the design of the 3G Mobile System radio interface(s) shall meet these requirements.

6.3.3.4 Spectrum Efficiency (ITU-R M.1034, Sec.11.3.4)

The spectrum efficiency of a 3G Mobile System radio network is a measure of the maximum number of active 3G Mobile System users that can be accommodated per area and spectrum, or per volume and spectrum in multi-floor buildings, for a given quality, cell size, propagation environment cost and design effort.

The spectrum efficiency of a 3G Mobile System radio interface shall be determined using the minimum cell size for the appropriate 3G Mobile System radio operating environment as the basis for the cell area. For non-voice services, an equivalent unit of traffic intensity must be calculated. The spectrum efficiency shall be based on fixed radio channel performances given in Recommendation ITU-R M.1079.

When evaluating spectrum efficiency, the effect of non- 3G Mobile System services in the same and adjacent frequency bands, and any guard bands resulting from these, shall be taken into consideration. Overhead such as control and signalling channels shall also be included in analysis of spectral efficiency.

6.3.3.5 Operational Reliability (ITU-R M.1034, Sec.11.3.5)

The 3G Mobile System radio interface(s) shall be designed in such a way that the operational reliability, including, for example, the mean time between failure (MTBF) for 3G Mobile System radio infrastructure in mature operation, can be at least as good as the reliability for corresponding second generation mobile systems, at reasonable cost.

In addition, the 3G Mobile System radio interface(s) shall be designed in such a way that the mean time to repair (MTTR) for 3G Mobile System radio infrastructure in mature operation, can be at least as good as the reliability for corresponding second generation mobile systems, at reasonable cost.

6.4 Required Bearer Channel Capabilities

Radio bearer channels for 3G Mobile?System should be designed to meet the QoS (User rate, BER, Delay in PLMN), applications, and network connectivity requirements listed in Table 6-1. Detailed description of each application is given in section 5.1.

Table?6-1?Required bearer channel capability for 3G System

Mode	BER	Delay in PLMN (ms)	User rate (Kbit/s)	Applications															Network Connectivity		
				Telephony	HQ Speech	HQ Audio (AM/FM)	Hi-Fi Audio Broadcasting	Video-R,T. Bi-dir. (TelQ/HQ)	Streamline Video	Video & Data Upload	Data-Real.T, Bi-directional.	Data Application	Voice-Band Data	Group3 Facsimile	Location Service	Short Message	Paging Service	Specific Dispatch Service	IP-based Service	ISDN	PSTN	Internet
				5.1.3.1	5.1.3.2	5.1.3.3	5.1.3.4	5.1.4.1	5.1.4.2	5.1.4.3	5.1.4.4	5.1.4.5	5.1.5	5.1.6	5.1.8.1	5.1.8.2	5.1.8.3	5.1.8.4	5.1.1.6			
Circuit	$<10^{-3}$ or $<10^{-6}$ $<10^{-4}$ *2	<80-110*3 150~400 *4	~8	Yes (10^{-3})	-	-	-	-	-	-	-	-	Yes	Yes	-	-	-	[Yes] [(TelQ)]	Yes	Bch	Yes	Yes
			8~16	Yes (10^{-3})	-	-	-	-	-	Yes (Down)	Yes	Yes	Yes	Yes	-	-	Yes	[Yes] [(TelQ)]	Yes			
			16~32	-	Yes (10^{-3}or-4)	Yes(AM) (10^{-6})	-	Yes (TelQ)	Yes (Audio)	Yes (Down)	Yes	Yes	Yes	Yes	-	-	Yes	-	Yes			
			32~64	-	Yes (10^{-3}or-4)	Yes(AM/FM) (10^{-6})	Yes (10^{-6})	Yes (TelQ)	Yes	Yes (Down)	Yes	Yes	Yes	Yes	-	-	Yes	-	Yes			
			64~128	-	-	Yes(FM) (10^{-6})	Yes (10^{-6})	Yes (TelQ/HQ)	Yes	Yes (Up)	Yes	Yes	-	-	-	-	Yes	-	Yes	2 x Bch /H0ch	N/A*9	
			128~384	-	-	Yes(FM) (10^{-6})	Yes (10^{-6})	Yes (HQ)	Yes	Yes (Up)	Yes	Yes	-	-	-	-	Yes	-	Yes	n x Bch/ m x H0ch /H11/H12 *7		
			[384 ~2000]	-	-	-	-	Yes (HQ)	Yes	Yes (Up)	Yes	Yes	-	-	-	-	[-]	-	Yes			
Packet	$<10^{-3}$ or $<10^{-6}$ $<10^{-4}$ *2	[<80-110 *3] [150~400] *4	~8	[-]	-	-	-	-	-	Yes (BE)	[-]	Yes (P or BE)	Yes	Yes	[Yes] (P or BE)	Yes(10^{-3}) (P or BE)	Yes (BE)	[-]	Yes	<16Kbps (Dch) <64Kbps (Bch) <384K (H0) <1536K *7 (H11) <1920K *7 (H12)	Yes	Yes
			8~16	[-]	-	-	-	-	-	Yes (BE)	Yes (P or BE)	Yes (P or BE)	Yes	Yes	-	-	Yes (BE)	[-]	Yes			
			16~32	-	[-]	[-]	[-]	Yes (P *5)	Yes (BE*6)	Yes (BE)	Yes (P or BE)	Yes (P or BE)	Yes	Yes	-	-	Yes (BE)	[-]	Yes			

			32~64	-	[-]	[-]	[-]	Yes (P)	Yes (BE)	Yes (BE)	Yes (P or BE)	Yes (P or BE)	Yes	Yes	-	-	Yes (BE)	[-]	Yes			
			64~128	-	-	[-]	[-]	Yes (P)	Yes (BE)	Yes (BE)	Yes (P or BE)	Yes (P or BE)	-	-	-	-	Yes (BE)	[-]	Yes		N/A	
			128~384	-	-	[-]	[-]	Yes (P)	Yes (BE)	Yes (BE)	Yes (P or BE)	Yes (P or BE)	-	-	-	-	Yes (BE)	[-]	Yes			
			[384 ~2000]	-	-	-	-	[-]	Yes (BE)	[-]	Yes (P or BE)	Yes (P or BE)	-	-	-	-	[-]	[-]	Yes			
Out channel *1	$<10^{-3}$	Not sensitive	~8	-	-	-	-	-	-	-	-	-	-	-	[Yes]	Yes	Yes	-	Yes	UUS*8	Yes	Yes

*1: e.g. Control channels (associated / dedicated / broadcast) *2: 10^{-4} may be required to compromize the delay with the quality for realtime video or high quality speech.
*3: Requirements for conversational speech (telephone) services. *4: Requirements for conversational real-time video services. *5: Priority specified packet *6: Best effort type packet.
*7: TSSI(Time Slolt Sequence Integrity) feature may be required as bearer channel capability. *8: User-User Information Service *9: N/A(Not Applicable)

6.5 Security and Privacy

6.5.1 High-level Requirements for Security and Privacy (extracts from ITU-R M.1078, sec 8.2)

The following requirements apply to the security and privacy provisions in a 3G Mobile System:

- •security features provided for the protection of the 3G Mobile System users should be user-friendly and easy to use; They should, as far as possible, be transparent to the users, and should require a minimum of user-interactions on a per call basis;
- •security features provided for the protection of the 3G Mobile System users should not significantly increase call set-up times;
- •security features provided for the protection of the 3G Mobile System users should work without reduced security during handover and when roaming;
- •it should be very difficult for intruders to impersonate the 3G Mobile users or network operators/service providers;
- •it should be very difficult to decipher the 3G Mobile System user's communication over the 3G Mobile System radio interfaces; This applies to any service information type or signalling information;
- •it should be possible under controlled circumstances for information over the 3G Mobile System bearer channel to be transmitted in the clear;
- •it should be very difficult for intruders to identify the 3G Mobile System users;
- •it should be very difficult for intruders to physically locate the 3G Mobile System users;
- •[it should be possible for the 3G Mobile System network operator to identify an unauthorised or stolen 3G Mobile System mobile terminal;]
- •the security to be provided by a 3G Mobile System should be adequately standardised to provide secure international interoperability and roaming; However, within the security mechanisms of a 3G Mobile System, the maximum independence between the parties involved in the 3G Mobile System operation should be allowed, as well as the maximum freedom for all parties to make their own security policies and mechanisms;
- •security keys and possible devices, such as the UIM, distributed to the 3G Mobile System users should be easily and securely managed and updated;
- •the security mechanisms provided by a 3G Mobile System should have a means for version management.

6.5.2 Security and Privacy Features (extracts from ITU-R M.1078, sec 8.3)

A 3G Mobile System shall provide the following features related to security and privacy.

6.5.2.1 Access Control for Subscription and Service Profile Data

This feature provides restrictions in the access to the personal data and the personal service profile of the 3G Mobile System user or subscriber stored in the network.

6.5.2.2 User Identity Authentication

This feature provides a means by which the identity of the 3G Mobile System user is verified to be the one claimed in order for the service not to be compromised by the fraud use.

6.5.2.3 UIM Holder Verification

This feature provides a means by which the human user of the UIM is authenticated to the UIM in order for the service not to be accessed by theft or unauthorised person. This feature may be locally implemented without interaction with the network.

6.5.2.4 User Data Confidentiality

This feature provides the privacy of communication by protecting the data of the 3G Mobile System user against interception over the 3G Mobile System radio interfaces. The feature applies to voice, or any other type of user data.

6.5.2.5 Signalling Information Confidentiality

This feature provides a means by which the signalling information is protected against interception over the 3G Mobile System radio interfaces.

6.5.2.6 User Identity Confidentiality

This feature provides a means by which the identity of the 3G Mobile System user is protected against disclosure over the 3G Mobile System radio interfaces.

6.5.2.7 User Location Confidentiality

This feature provides the privacy of the 3G Mobile System user by protecting the physical location of the user against disclosure over the 3G Mobile System radio interfaces.

6.5.2.8 Network Operator/Service Provider Authentication

This feature provides a means by which the identity of the 3G Mobile System network operator/service provider is verified to be the one claimed. This feature may effectively be achieved by authenticating the network operator to which the user is accessing.

6.5.2.9 Re-authentication of Users

This feature provides a means by which the identity of the 3G Mobile System user is re-verified to be the one claimed. This feature may be invoked repeatedly or at any appropriate instant.

6.5.2.10 Subscriber Access to Service Profile

This feature provides a means by which the 3G Mobile System subscriber has a direct and limited access to the personal service profile of him or his associated users, by means of which

he may be able to restrict access to services, etc.

6.5.2.11 Version Control of Security Data and Mechanisms

This feature provides a means by which security data and mechanisms can be updated and controlled between the parties involved.

7 Network Management (ITU-R M.1168, Sec.7)

7.1 Recommendations for 3G Mobile System management standardization (ITU-R M.1168, Sec.7.1)

7.1.1 Objectives (ITU-R M.1168, Sec.7.1.1)

3G Mobile System management should be defined in compliance with the following objectives:

1) To provide a management architecture, in order to support a multi-vendor 3G Mobile System environment.

2) To define management information to be exchanged across standardized interfaces in terms of OSI model.

3) To support the capability of controlling a 3G Mobile System itself as far as possible.

4) To address the management and assessment of system performance and operation through the use of measurements, etc.

Note:

- *This would enable a 3G Mobile System operator to make comparisons with its service quality criteria and objectives.*

5) To improve service assistance and interaction with customers.

6) To address a flexible billing and accounting administration, so as to support charging across a 3G Mobile System and non- 3G systems.

7) To support the capability of geographical dispersion of control functions

8) To provide common methods for the provisioning of 3G Mobile System services by 3G Mobile System management.

9) To provide the capability to report events and reaction in a common way, in order to enable remote control and to simplify maintenance interventions.

10) To minimize the complexity of 3G Mobile System management.

11) To minimize the load caused by management traffic when the telecommunications network is used to carry it.

12) To define methods and control to be employed to effect as quick as possible set up and changes to the system.

Note:

- *This would enable a safe, continuing extension and enhancement of offered 3G Mobile System services.*

13) To enable the support and control of a growing number of resources. This would allow the system to start from a small and simple configuration and to grow as needed both in size and complexity.

14) To support the system to be configured for the condition of not only a high traffic area but also a low traffic area, e.g. rural remote area.

15) To allow for enough flexibility in the configuration of the system such that particular 3G Mobile System operator requirements concerning the availability of 3G Mobile System services may be met.

16) To address the convergence of 3G Mobile System management for the operation of terrestrial and satellite components of a 3G Mobile System.

17) To allow also the management of 3G Mobile System radio-connected 'infrastructure' (e.g. mobile base stations).

18) To address interworking between 3G Mobile System operators, whether public or private, covering overlapping or adjacent areas.

Note:
- *This will allow 3G Mobile System services provision by more than one operator in any area of coverage, and a continuity of service between 3G Mobile System environments.*

19) To specify standards to support the exchange of necessary and/or desirable management information between 3G Mobile System operators, whether public or private.

Note:
- *This would support inter-operators roaming from mobile users.*

20) To reuse the existing relevant standardization work on management of PLMN, IN, ISDN/B-ISDN, etc. already carried out by other standardization bodies.

21) To address 3G Mobile System interworking with a wide range of existing or future partner networks and services such as other mobile networks, ISDN, B-ISDN, PSTN, UPT.

22) To support and control the management of the security aspects in a 3G Mobile System such as cryptographic key administration and access control management.

23) To facilitate the evolution of existing and developing mobile telecommunication networks and systems towards a 3G Mobile System.

7.1.2 General Requirements for 3G Mobile System Management

(ITU-R M.1168, Sec.7.1.2)

The objectives for 3G Mobile System management must now be analyzed from different viewpoints (e.g. service quality aspects, Management Functional areas) to identify general requirements for 3G Mobile System management.

Notes:
- *3G Mobile System operator refers to a 3G Mobile System network operator or a 3G Mobile System service provider or to both of them, according to how the responsibility is shared between the network operator and the service provider.*
- *A direct assignment of O&M functions and activities to functional blocks is not possible before the definition of network architecture. This statement is at the moment valid for all network components of a 3G Mobile System.*

7.1.2.1 Service Quality (ITU-R M.1168, Sec.7.1.2.1)

3G Mobile System operators should be able to select criteria for the evaluation of the 3G Mobile System service quality. The following requirements, from an operator's perspective, have been identified:
- to recognize the kind of service and related service quality,
- to monitor the service quality,
- to be able to recognize the different kinds of terminal,
- to support handover between networks while maintaining the appropriate quality,
- to support the demand of users to communicate in every network with the appropriate service quality,
- to support the functionality to indicate degraded service quality to the user/terminal,
- to cooperate on service quality issues with other network management systems.

7.1.2.2 Service and Business Areas (ITU-R M.1168, Sec.7.1.2.2)

This section provides the general 3G Mobile System management requirements, from a 3G Mobile System operator point of view, for the following aspects:

- subscriber and user administration,
- charging and billing (e.g. collection of charges from subscribers),
- inter-operator accounting (e.g. collection of charges from other operators),
- service management.

7.1.2.2.1 Subscriber and User Administration (ITU-R M.1168, Sec.7.1.2.2.1)

3G Mobile System management should include the management functions associated with the administration of data (possibly distributed over several databases), related to the provision of 3G Mobile System services to subscribers and users. The use of a unique user identification and of a unique equipment identification needs to be foreseen.

Every user is associated with a subscription. Every subscription is associated with a service provider.

7.1.2.2.2 Charging and Billing (ITU-R M.1168, Sec.7.1.2.2.2)

In a 3G Mobile System there will exist different possibilities to charge for calls:

a) Normal case
   In this case usage records are created by the network operators. These usage records will be collected by the appropriate service providers for billing.
b) Hot billing after the call (credit card callings)
   In this case the network operator bills card agency for the call after collection of all relevant usage records.
c) Hot billing during the call (prepaid cards or cash)
   In this case the network operator deducts units from the prepayment while the call is in progress.

3G Mobile System management should provide the means to apply proper charging according to case a) - c).

Usage records are transferred to the Service Provider of the involved users.

Originating, transit and terminating 3G Mobile System operators should be able to do usage metering.

Usage metering of network resources for the purpose of billing shall be the responsibility of the network operator.

3G Mobile System management should enable 3G Mobile System operators to register certain kinds of handovers, in order to be able to charge differently depending on handover cases (e.g., terrestrial/satellite).

3G Mobile System management should enable 3G Mobile System operators to charge for the usage of location management procedures.

In order to enable different charging techniques during the call (e.g. directly to the user), 3G Mobile System management should provide mechanisms to manage the exchange of charging information, e.g., when a handover is invoked.

7.1.2.2.3 Inter-Operator Accounting (ITU-R M.1168, Sec.7.1.2.2.3)

Inter-operator accounting should be verifiable. This implies that when traffic over a given connection or link between two 3G Mobile System operators is to be charged, usage metering needs to be done on both sides: outgoing (Operator A) and incoming traffic (Operator B).

The service provider will be able to collect usage records relating to use of resources from all involved network operators.

Inter-operator accounting should result in an exchange of usage metering information based on the actual route.

Usage metering of signalling traffic (out of call procedures: e.g. interrogation, location updates) for the purpose of inter-operator accounting might be needed.

7.1.2.2.4 Service Management (ITU-R M.1168, Sec.7.1.2.2.4)

3G Mobile System management should allow the use of a 3G Mobile System for the purpose of providing its services to fixed users.

3G Mobile System management should support the use of a 3G Mobile System for the purpose of providing its services to fixed users, as well as to mobile users.

3G Mobile System management should allow service management even in the case of shared infrastructure.

3G Mobile System management should support 3G Mobile System operation (interworking) with a wide range of existing or future partner networks and services (e.g. other mobile networks, ISDN/B-ISDN, PSTN, UPT). This should allow the desired services to be offered in a cost effective way.

7.1.2.3 Security Management Area (ITU-R M.1168, Sec.7.1.2.3)

This section provides the general 3G Mobile System management requirements for the following aspects:

- management of 3G Mobile System specific security mechanisms and algorithms,
- key management,
- encryption management,
- authentication management,
- access control management,
- service barring list management,
- security audit management,
- management of subscriber related credential information,
- information exchange regarding security management.

Notes:

- *Security management standardization is concerned with the management functions allowing 3G Mobile System operators to perform administration of the security features of the network (e.g. handling of security alarms).*
- *Security management standardization is not concerned with the definition of security features (e.g. cryptographic key generation and distribution).*

7.1.2.4 Performance Monitoring Area (ITU-R M.1168, Sec.7.1.2.4)

This section provides the general 3G Mobile System management requirements for the following aspects:
- performance data generation and collection (e.g. for QoS/GOS analysis),
- traffic measurements,
- subscriber activity tracing.

3G Mobile System management should support the use of measurements from, e.g. handover, user registration, location updating and paging, for performance and planning purposes.

The measurement data produced by the network could be used for:
- traffic measurements (e.g. successful/unsuccessful handovers per a group of base stations per hour);
- evaluation of current network configuration (e.g. ratio of handover attempts and successful handovers per cell). The measurement results can be further processed in the network planning and reconfiguration part of TMN;
- evaluation of possible fault situations around the 3G Mobile System network (e.g. number of successful and failed handovers per source/target cell).

7.1.2.5 System Configuration Area (ITU-R M.1168, Sec.7.1.2.5)

This section provides the general 3G Mobile System management requirements for the following aspects:
- spectrum management,
- system extension (e.g. introduction of a new network element or function),
- system reduction (e.g. removal of a network element or function),
- system modification (e.g. change of an existing network element or function),
- interworking with other systems.

3G Mobile System management should support:
- the flexibility to manage a wide range of cell types,
- reconfiguration of assigned frequency blocks (spectrum management) in response to changing traffic, service requirements or spectrum allocation, allowing efficient and economical use of the radio spectrum,
- provision of access to 3G Mobile System dependent on the mobile terminal type or location,
- provision of access to a 3G Mobile System for fixed users,
- reconfiguration of the system without disrupting the normal provision of services,
- the management of the relevant configuration information used by 3G Mobile System specific radio interface protocols, e.g. cell identities,
- the control of handover configuration e.g. by allowing the selection of the handover algorithm, the selection of the candidate cells for handover for each cell individually, the

configuration of the handover function, and the management of handover mechanisms characteristics,
- operators' ability to initiate maintenance activities (e.g. to clear a cell by forced handovers or no admittance of new calls),
- the management of 3G Mobile System mobile network elements configuration (e.g. mobile base stations).

7.1.2.6 Maintenance Area (ITU-R M.1168, Sec.7.1.2.6)

Operators need to maintain the system (telecommunication equipment) in a state where the quality of offered services to the subscriber is acceptable. Maintenance includes techniques that aim to minimize the loss of service caused by a failure.
This section provides the general 3G Mobile System management requirements for the following aspects:
- pro-active maintenance (e.g. routine maintenance activities, transmission relevant failure information to manufacturers),
- detection/localization/isolation of failure (e.g. monitoring, analysis of operating trends, analysis of customer complaints),
- reactive maintenance (e.g. repair and restore the network functions).

Note: *It could be expected that most faults in terminals have no impact to the network, meaning they do not disturb the network. In this case fault detection and repair is not a concern of the network operator. On the other hand there may be faults in terminals which do disturb the network. In this case it is necessary for the network operator to have the capability to deal with these problems. This subject is for further study.*

7.1.2.6.1 Pro-active Maintenance (ITU-R M.1168, Sec.7.1.2.6.1)

The main purpose of pro-active maintenance is to minimize failure occurrences. For example, the following mechanisms can be used:

- self tests, may be used to ensure correct functioning prior to operation;
- test loops, may be used to ensure correct communication prior to operation;
- a maintenance friendly design of the equipment, so that normal maintenance activities can easily be performed by the maintenance staff;
- provision of redundant units of equipment, (these units may be on hot or cold standby, depending on requirements): such units should be proved for all important units necessary to maintain the operation;
- arrangement of equipment of the network in such a way that, in case of a failure, the active part of the network can be switched to an equivalent circuit;
- establishment of a database of failure for forecasting purpose.

7.1.2.6.2 Detection/Localization/Isolation of Failures (ITU-R M.1168, Sec.7.1.2.6.2)

Detection and localization mechanisms are necessary to recover from system failures. Isolation mechanisms are necessary to minimize the impact of these failures.

If a failure occurs, this can have different effects on services depending where the fault occurs. Understanding the severity of the fault is necessary to determine the required speed of repair. For example, the following mechanisms may be used for detection, localization and isolation:

- failures have to be able to be reported in alarm messages, with information facilitating the localization and severity assessment;
- generation of alarms if 3G Mobile System performance, e.g. handover performance, is below a pre-defined threshold;
- detection and evaluation of discrepancies between two hot standby units;
- recording and evaluation of call characteristics (e.g. statistical surveys of calls to avoid or to detect faults);
- analysis of user complaints;
- the ability to perform regular and automatic testing, and test functions or facilities which can be activated on site;
- facilities to check status information of all units;
- analysis of operating trends to detect or describe failures using history databases;
- performance of alarm correction, e.g. using an expert system.

7.1.2.6.3 Reactive Maintenance (ITU-R M.1168, Sec.7.1.2.6.3)

Once the detection, localization and isolation of the failure has been accomplished, the faulty unit (software or hardware) must be repaired or replaced.
In order to support effective maintenance, 3G Mobile System management should provide the following information:
- equipment/system status,
- load levels,
- trouble conditions,
- activated network management control.

When existing, the redundant units must overtake the operation.

In order to verify the repair, it is useful for the maintenance staff to have access to the management network to initiate tests.

In case of replacement, the consistency between software and hardware versions must be verifiable.

7.2 Principles and Guidelines for the specification of 3G Mobile System management Recommendations (ITU-R M.1168, Sec.7.2)

7.2.1 General (ITU-R M.1168, Sec.7.2.1)

The target of 3G Mobile System management is to offer a variety of functions such as planning, installation, provisioning, operation, maintenance, administration and customer services under a multi-vendor and multi-operator environment. The concept of TMN, which has been studied by ITU-T, is most beneficial for providing these functions. A 3G Mobile System should apply the TMN concept to its network management.

Hereafter are provided principles and guidelines for the specification of the 3G Mobile System management, particularly the 3G Mobile System specific TMN management service. These 3G Mobile System management recommendations should finally reflect the 3G Mobile System management objectives and requirements, as defined in this framework recommendation. In order to assist in achieving this goal, the scope of each planned 3G Mobile System management recommendation is clarified hereafter.

7.2.2 TMN Management Service for a 3G Mobile System

(ITU-R M.1168, Sec.7.2.2)

This Recommendation should follow the new template of ITU-T Recommendation M.3020 for the definition of a TMN Management Service. This includes the provision of: a management service description, management goals, a management context description, roles, resources, TMN Management Functions, management scenarios, and the architecture.

This Recommendation should take into account the need for the following 3G Mobile System specific management activities:

- 3G Mobile System subscriber, mobile equipment and service data administration,
- 3G Mobile System charging and accounting management,
- 3G Mobile System security management,
- 3G Mobile System performance management,
- 3G Mobile System configuration management and administration,
- maintenance of 3G Mobile System infrastructure.

The exchange of management information between 3G Mobile System operators (service providers or network operators) should be addressed, when relevant, for each of these management activities.

7.2.3 TMN Management Function Sets (ITU-R M.1168, Sec.7.2.3)

ITU-T Recommendation M.3400 "TMN Management Function Sets" will contain the specification of both generic and specialized functionality related to TMN Management Functions, and needed for all telecommunications activities.

ITU-T Recommendation M.3400 will provide the specification of the TMN Management Function Sets to be used for 3G Mobile System management, according to the specification of the 3G Mobile System TMN Management Service Recommendation. The description for TMN Management Function Sets will follow the new template of ITU-T Rec. M.3020. This includes the provision of: management requirements, a functional model, summary description of each TMN Management Function, and detailed description of the management information.

7.2.4 3G Mobile System Management Information (ITU-R M.1168, Sec.7.2.4)

This Recommendation should provide the definition of 3G Mobile System Management Information which will be exchanged across standardized interfaces, according to the specifications of the Recommendation "TMN Management Service for FPLMTS".

This management information should be used to manage a 3G Mobile System, as required and specified in the relevant TMN Management Function Sets. The 3G Mobile System management information should be described using the object-oriented paradigm in the ISO/ITU-T GDMO (Guidelines to Define Managed Objects) formal style (see ITU-T Recommendation X.722). Related work from other standard groups will be reused whenever possible and discussed within the context of 3G Mobile System management.

8 Requirement for Satellite Component

8.1 Services provided by 3G Mobile System satellite component should include but not be limited to, the following:

- a paging (alerting) one-way data service direct from a satellite to a 3G Mobile System satellite pager (SP);
- two-way voice or non-voice services should be provided for the following configuration:
  - service directly to/from a mobile earth station (MES);
  - service directly to/from a personal earth station (PES). The PES would comprise equipment and protocols fully or partially compatible with the terrestrial-based 3G Mobile System personal station;
  - service to/from users connected by a local exchange (LX) via an MES;
  - service directly to/from a personal station (PS) communicating via an MES. In the case of vehicles with multiple users a cell station (CS) (cell site for PSs) may be included in the vehicle between the PSs and MES.

FIG. 8-1 shows some examples for satellite operation involved with a 3G Mobile System; **(ITU-R M.818-1, Recommends 1)**

8.2 The signallig protocols of satellite component of a 3G Mobile System should follow the relevant ITU-T Signalling Recommendations, with special emphasis on establishing physical and logical modularity for those elements that may differ between satellite and terrestrial components; **(ITU-R M.818-1, Recommends 2)**

8.3 Links are needed between the terrestrial and satellite network control element of a 3G Mobile System to facilitate handovers and exchange of location registry data and other management information; **(ITU-R M.818-1, Recommends 3)**

8.4 In the frequency bands identified by WARC-92 for operation of 3G Mobile System satellite component, account should be taken of the constrains to be established for sharing other services; **(ITU-R M.818-1, Recommends 4)**

8.5 Protocol be developed to establish whether a terrestrial or satellite component be used for given call; **(ITU-R M.818-1, Recommends 5)**

8.6 Compatible but not necessary identical multiple access schemes should be developed for the terrestrial and satellite components ; **(ITU-R M.818-1, Recommends 6)**

8.7 The user presentation and operation of the PES shall be as similar as possible to that of PS; **(ITU-R M.818-1, Recommends 7)**

8.8 Within the bands identified, common frequency channel be used to facilitate world-wide and regional planning and operation; **(ITU-R M.818-1, Recommends 8)**

8.9 The provision of services for satellite 3G Mobile System users has to take into account a number of factors which are particular to satellite communications. These derive from the nature of the radio-frequency channels involved in combination with the operational consideration of the economics of service provision to a wide range of user or traffic densities (users/km^2 or Erlangs/km^2). **(ITU-R M.1167, Sec.9.1)**

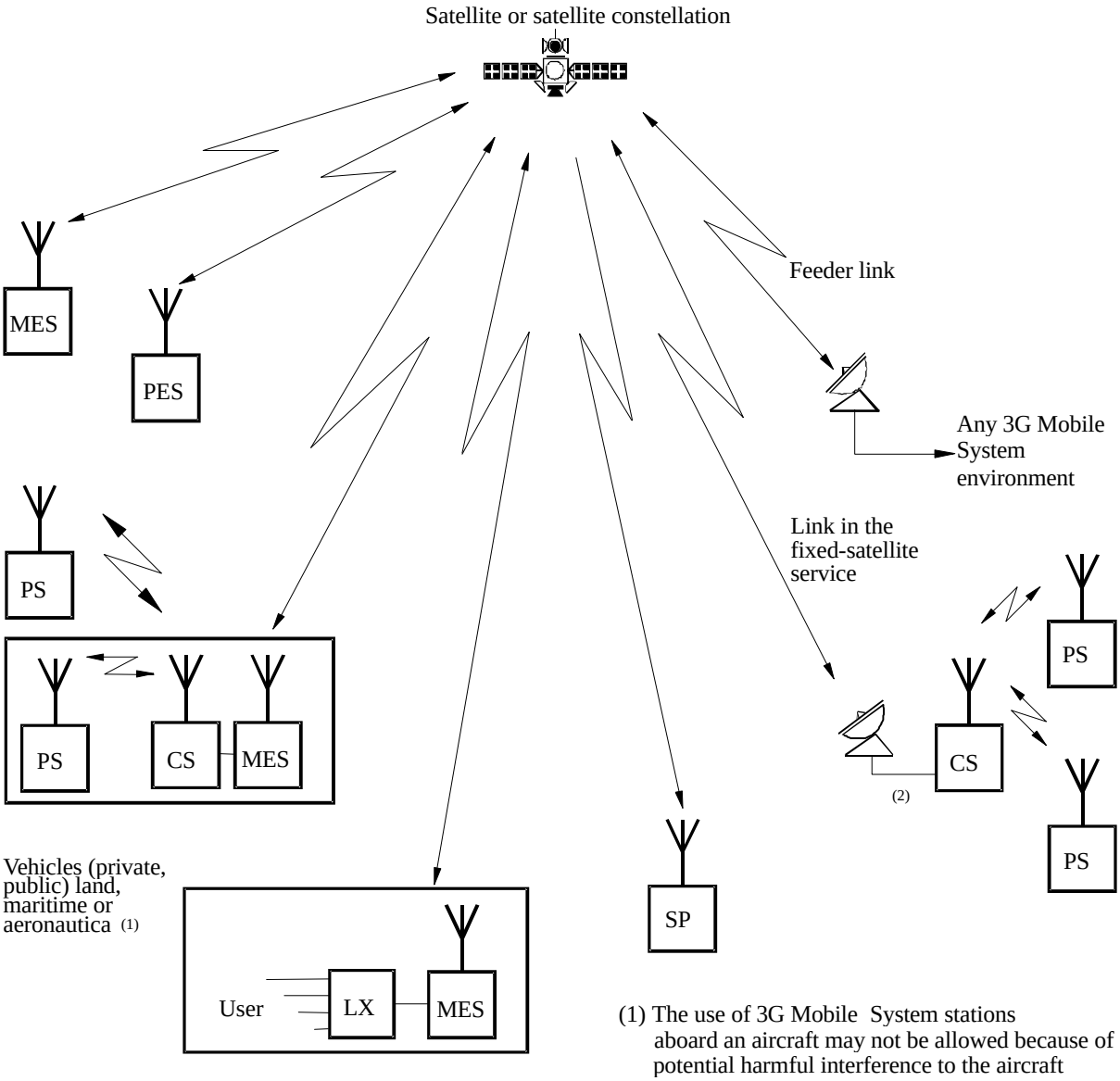
8.10 Service provided by the satellite component should be of comparable quality to the terrestrial component of a 3G Mobile System, where it is possible, bearing in mind the particular constraints of satellite systems such as power, spectrum, and propagation delay. **(ITU-R M.818-1, Recommends 10)**

8.11 Satellite links operating in the fixed satellite service (FSS) bands providing 3G Mobile System service indirectly via fixed earth station (FES) are not a part of the satellite component of a 3G Mobile System but constitute an FSS connection in support of a 3G Mobile System. An example of such a connection is illustrated in FIG. 8-1.

(ITU-R M.818-1, Recommends 11)

FIG. 8- 1 (ITU-R M.687-2, FIGURE 2)

Some configuration examples for the satellite component of a 3G Mobile System



(1) The use of 3G Mobile System stations aboard an aircraft may not be allowed because of potential harmful interference to the aircraft electronic systems.

(2) Fixed earth station.

PES: personal earth station (hand held)
MES mobile earth station
SP: satellite pager
CS: cell station
LX: local exchange
PS: personal station

9 Requirements for Fixed Wireless Access (FWA) Applications

9.1 General FWA Requirements

A 3G Mobile System provides both technically and economically perfect platform for FWA application. Modifications to a 3G Mobile System should be kept at minimum in order to achieve commercially potential 3G FWA system. However, the needed FWA specific modifications should be added to a 3G Mobile System without effecting too much to the cost of the 3G FWA system. By doing so cost per subscriber in FWA system would be low enough due to the mass production of 3G system.

When 3G Air Interface is used, it creates a possibility to provide service for both fixed and mobile users through the same 3G FWA system. This important requirement is already pointed out in ITU-R M.819-2. To ensure service for both fixed and mobile users 3G Air Interface should be kept the same for 3G FWA system (speech codec etc.). Only very limited changes to a 3G Mobile System can be allowed. Changes which are shown to be essential for FWA application within 3G, do not affect to cost issues too much and which can be implemented easily to a 3G Mobile System should be allowed.

9.2 System Requirements

9.2.1 General System Requirements

ITU-R M.819-2 and ITU-R M.687-2 include general requirements for 3G FWA application. Following list gives the general requirements:

- to provide, in both urban and rural areas, economical services of high quality and integrity comparable to those of the fixed public network. The systems must be capable of serving a wide range of user densities and coverage areas as well as remote regions; (ITU-R M.819-2, recommends 1)

- great importance has to be given to an open, flexible architecture which is able to match network investments to revenue growth, and can adapt readily to environmental factors, different applications and new developments; [ITU-R M.819-2, Annex 1, sec. 4.3]

- must be capable of providing services to both mobile users and fixed users with minimum initial investments; [ITU-R M.819-2, recommends 2-3]

- to provide a simple start-up with the provision of basic telephone services that can evolve, as required, to higher user information rates in the local loop and to a full mobility service;
[ITU-R M.819-2, Annex1,sec.3]

- to provide a simplest possible system (e.g. speech alone), both from the point of view of hardware (terminals, base stations) and software; [ITU-R M.819-2, Annex1, sec.4.3]

- to provide a modular structure to permit simple configurations and future growth is of particular importance in developing countries; [ITU-R M.819-2, Annex1,sec.4.3]

• the system should be able to be configured for situations of high traffic per terminal; (ITU-R M.819-2, Annex 1, sec.4.3)

• there are three aspects which are important for the fixed service application of 3G; (ITU-R M.819-2, Annex 1, sec.7.2):
- the cells tend to be large; the distance to be covered is often greater than is possible in one cell, while the number of subscribers is very low in all cells;
- the radio paths are well-defined; and
- the average traffic level per subscriber is typically 3 to 4 times higher than in the mobile services.

• extension of the cell size is allowed in rural or remote area, without constraint to the specification of the radio interface; (ITU-R M.687-2, sec.1.3.12]

• to support terminal equipment interfaces (and procedures) defined for the fixed public networks which allow the alternative use of terminal equipment in the fixed public networks; (ITU-R M.687-2, sec.1.2.5)

• to provide, as far as practical, services with a quality of service comparable to the fixed networks; (ITU-R M.687-2, sec.1.1.4)

• to provide for the continuing flexible extension of service provision, subject to the constraints of radio transmission, spectrum efficiency and system economics; (ITU-R M.687-2, sec.1.1.5)

• to provide for additional level of security (for voice and data services) compared to the fixed network. In addition, to allow for the provision of encryption through the FWA- system for voice and data services; (ITU-R M.687-2, sec.1.2.3 and 1.2.4)

• to aid the emergency services by providing additional emergency call information as far as possible, e.g. user identity, location information, and other information that may be required by national or local authorities; (ITU-R M.687-2, sec.1.3.8)

• to provide for unique user identification and numberings in accordance with appropriate ITU-T Recommendations; (ITU-R M.687-2, sec.1.3.2)

• to provide for a unique equipment identification scheme; (ITU-R M.687-2, sec.1.3.3)

• that hardware be capable of being optimized for local conditions e.g. to take account of heavy usage, operation in a variety of environments including extremes of heat and cold, high humidity, dust, corrosive atmospheres and other environmental hazards, recognizing the need to achieve long equipment lifetimes, high MTBF and low maintenance that permit a reasonable justification of the required investment; (ITU-R M.819-2, recommends 5)

• that equipment is designed to take into account the need for low power consumption and the need to operate from a range of power sources; (ITU-R M.819-2, recommends 9]

• some form of security management should be supported by the system in order to detect and prevent misuses of the fixed stations.

- some form of flexible mobility management should be supported by the system.

It is recommended that the system is designed to take into account the timer requirements of existing terminal equipment and networks.

9.2.2 System Configurations

Due to the different needs in different environments two separate FWA network level solutions are needed. Those two systems are named here [1] as FWA based on Mobile System and FWA based on Access System. It is believed that both network level solutions are needed in order to satisfy the needs of different operators and end-users.

9.2.2.1 FWA based on Mobile System

The FWA based on Mobile System should be based on the standard mobile network and Mobile services Switching Center (MSC) (for more detailed description see Annex 7). This solution meets, especially, the needs of mobile operators seeking for FWA subscribers and also to greenfield operators who start their operations with FWA and later seek to enhance their service offering to mobile users.
The below additions need to be made to an ordinary 3G Mobile System in order to create FWA based on Mobile System. These additions are:

- FWA subscribers can have wireline (i.e. PSTN-like) numbers.
- FWA subscribers could have local area dialing capability (dial tone, etc.) similar to that of a fixed Public Switched Telephony Network (PSTN) subscriber.(Note)

  Note: This is depending on which core network is used, whether it is possible to implement or not.
  - FWA subscribers typically have some form of mobility restriction. The operator can define the mobility (service area) for each subscribers individually. These subscribers can then only get telephone service inside his/her FWA service area.
- FWA subscribers' tariffing structure can be selected by the operator. Wireline-like (PSTN-like) tariffing scheme can be used if required.
- In order to achieve faster call set-up times, transparent mode is needed as an alternative option in FWA based on Mobile System solution
  - FS terminal remote management

9.2.2.2 FWA based on Access System

The FWA based on Access System comprises of the FWA Access Node, the standard Base Stations (BS), FWA stations and standard Terminal Equipment (for more detailed description see Annex 7). This solution is offered to those operators who need to connect the FWA system directly to the service node (i.e., local exchange, router). The specific signaling schemes vary from country to country and are standardized by respective PTTs or government regulatory bodies. Thus the signalling in FWA based on Access System has to be adapted according to the national fixed public network protocol mapping specifications.

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[1] EDITOR'S NOTE: Can be naturally named differently.

9.2.2.3 Relocation capability of FWA terminals

In order to fulfill different operators' needs, a possibility to use different FWA terminals (FWA station and mobile station) is needed. In addition to this different degree of relocation capability for terminals are needed. Each operator can choose the best suitable terminal configuration (no mobility, restricted mobility, etc.) for operator's FWA system.

<u>FWA based on Mobile System:</u>

FWA Station:
- optimized for residential use.
- The terminal is fixed (possibly movable within one radio cell coverage).

FWA Station with portability:
- Optimized for residential use.
- The terminal is not movable while having a call/connection ongoing.
- The terminal can be moved between two calls/connections.
  - Operator should be able to allow limited portability according to operators license agreement.
- Operator should be able to restrict portability with accuracy which is available in the 3G Mobile System.

MS:
- A standard mobile station for 3G Mobile System for personal use (incl. FWA UIM)
  - Operator should be able to allow mobility and/or roaming according to operators license agreement and possible roaming agreements.
- Operator should have a possibility to limit mobility within several cells if operator desires so.

<u>FWA based on Access System:</u>

FWA Station:
- Optimized for residential use.
- The terminal is fixed (possibly movable within one radio cell coverage).

FWA Station with portability:
- Optimized for residential use.
- The terminal is not movable while having a call/connection ongoing.
- The terminal can be moved between two calls/connections.
- Operator should be able to allow limited portability according to operators license agreement
- Operator should be able to restrict portability with accuracy which is available in the 3G Mobile System

MS:
Standard mobile station for 3G Mobile System is not supported, because the mobile network is needed in order to be able to support MS.

Note: The following terms used in this section are defined as below. The definitions here are only for the purpose of clarification of the FWA requirements;

Portability: a terminal has “portability” if and only if it can be moved between two calls or connections.

Mobility: a terminal has “mobility” if and only if it supports full mobility including handover capability defined for 3G Mobile System.

Mobile Station (MS): The user terminal that supports “mobility”.

FWA Station : The user terminal whose capability in terms of relocation conforms to the definition in this section.

FWA terminal : aggregated term consisting exclusively of FWA Station and Mobile Station.

9.2.2.4 FWA Call Set-Up Procedures

In order to satisfy the needs of different customers (operators and end-users) there needs to be two different call set-up procedure modes for both FWA systems: the transparent mode and the non-transparent mode (for more detailed description see Annex 7).

9.3 Service Requirements

FWA should be able to offer the same basic services that the core network is offering. However, in some cases (depending on operators’ license agreements, business cases etc.) this might not be possible. In some cases it might be possible that FWA based on Mobile System offers similar services as normal 3G Mobile System with additional PSTN/ISDN type services. Whereas in some cases it might be possible that FWA based on Access system offers only PSTN/ISDN type services.

The purpose of this section is to outline FWA services which are not commonly understood as standard mobile services.

These are explanations of services done differently in mobile network and fixed network in general.

9.3.1 Hook-flash and DTMF Tone Transmitter

FWA should support the basic services provided by the local switch that is connected to the FWA terminal. Most modern digital switching systems support a set of standard services.
FWA system should be able to support all services supported by hook-flash and DTMF tones.

9.3.2 Voice-band Data and Facsimile

Voice-band data and analog Group 3 Facsimile should be supported by the system. The use of PCM codec should be option in order to reduce processing delay problems and unnecessary protocol conversions.

9.3.3 Payphone

FWA system should support functions of different kind of payphones (coin phones, credit phones etc.). Tariffing for the payphones is based on the Advice of Charge information supported by the system.

In the case of existing coin phones, after Fixed Station has received tariff frame (Advice of Charge Message), it generates requested amount of pulses to payphone interface.

9.4 Network Management

9.4.1 General

Network management of FWA network elements (e.g. alarms of faulty base stations) is mainly handled with the same means as will be standardized for normal 3G Mobile System. In addition to a 3G Mobile System network management, the FWA system should support FS management including: remote testing, configuration of the subscriber FS, subscriber tests (terminal interface test, loop test ,etc.) and software downloading (SW downloading should be done in similar methods as in a 3G Mobile System) to the subscriber wireless unit (for more detailed description of Network management see Annex 7).

9.4.2 Performance Monitoring

There should be a possibility to measure and monitor following parameters: signal levels, BER, power levels, etc.. It is important that these parameters can be monitored, because terminal can be mounted to the wall for a long time and thus there can some unexpected changes in the environment over the years (for example new buildings in the neighborhood etc.).

9.4.3 Fault Management

Because the operation of the FWA FS must be ensured in all conditions, there is need to use some kind of testing procedures to get constant reports concerning faulty FS. One simple way to test the FSs is to make a certain test call from base station to FS to which FS needs to answer with predeterminated message. With this function the network set ups a call to certain point to the FS, but releases the call before the ringing tone. Such tests can be executed whenever necessary (for example during low traffic times like at night times) or test can be depended on the traffic load.

9.4.4 Other Electrical Parameters Management

There needs to be some form of testing procedure in order to monitor the electrical parameters of fixed station: loop status, operation voltages and loop current of 2-wire interface and the charge level of the battery backup unit (if the battery backup unit is installed).

9.4.5 Configuration Management

There should be a possibility to make some configurations over the air: feature status query, activation of new features, deactivation of new features, etc.

Volume 1 Annex 1 List of Terminology

1. Terms

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
1	3G Mobile System		Sec. 1*, 2*, 3*, 4*, 5*, 6*, 7*, 8*, 9*, Annex 2, 5, 6, 7 Appendix 1(Sec. 5.1, 5.6)	Japanese interpretation of IMT-2000.	
2	3G Mobile System network operator		Sec. 6.3.2, 6.5.1, 6.5.2.8, 7.1.2	A legal person or entity ultimately responsible for providing complete 3G Mobile System network functionality to 3G Mobile System user. Parts of the complete 3G Mobile System network functionality may however, be provided by other parties.	Referred from ITU-R M.1224
3	3G Mobile System radio interface		Sec. 4.1.1.3, 6.1*, 6.2*, 6.3*, 6.5*, Annex 6, Table A6-1	The means of realizing the wireless electromagnetic interconnection between a 3G Mobile System mobile station (or mobile earth station) and an 3G Mobile System base station (or space station). NOTE 1 - The 3G Mobile System radio interface specification consists of a statement of the form and content of the signals transmitted from stations. The specification contains the definition of functional characteristics, common radio (physical) interconnection characteristics, signal characteristics, and other characteristics, as appropriate.	Referred from ITU-R M.1224
4	3G Mobile System service provider		Sec. 6.1.3.3, 7.1.2,Annex 6	A legal person or entity responsible for providing 3G Mobile System subscriptions to 3G Mobile System subscriber.	Referred from ITU-R M.1224
5	3G Mobile System subscriber		Sec. 6.5.2.10, 7.2.2	A legal person or entity associated with the 3G Mobile System subscription and responsible for the charges incurred by his associated 3G Mobile System user. NOTE 1 – 3G Mobile System subscriber may be responsible for several 3G Mobile System users	Referred from ITU-R M.1224
6	3G Mobile System user		Sec. 5.1*, 6.3*, 6.5*, 8.9, Appendix 1 (Sec. 5.6) , Table A5-2	A person, entity or process actually using the 3G Mobile System services. A 3G Mobile System user is associated with a unique user identity.	Referred from ITU-R M.1224
7	Access node	AN	Sec. 9.2.2.2, Annex 7	A node which provides interactions between user and network.	
8	Accounting		Sec. 5.1.1.2, 7.1.1, 7.1.2.2, 7.1.2.2.3, 7.2.2	A function which apportions the revenue obtained by the service providers to network operators in line with commercial arrangements.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
9	Advice of charge		Sec. 9.3.5, Table A5-6	A supplementary service offering the possibility for a mobile user to reach charging information related to the used telecommunications services. NOTE 1 – This service may include one or more of the following cases: – charging information at the end of the call; – charging information during a call; – charging information at call set-up time.	Referred from ITU-R M.1224
10	Anchor mobile services switching Center	AMSC	Annex 7(Sec. 3)	The AMSC constitutes the interface between the radio system and the PSTN. The AMSC performs all necessary signalling functions in order to establish calls to and from mobile stations.	
11	Authentication		Sec. 1.3, 3.3, 5.1.1.2, 6.3.2.11, 6.5.2.2, 6.5.2.8, 6.5.2.9, 7.1.2.3, Appendix 1(Sec. 5.4, 5.5), 1-3(Sec. 2.2), Table A5-10	The process of verifying the identity of a user, terminal, or service provider.	Referred from ITU-R M.1224
12	Authorization	AUTZ	Table A5-10	A property by which the rights to resources are established and enforced.	Referred from ITU-R M.1224
13	Base station	BS	Sec. 2.4, 3.2, 4.1*, 6.2.2.3, 6.3*, 7.1*, 9.2*, 9.4*, Annex 2, 7(Fig. 1), Appendix 1(Sec. 3.2, 4), 1-1, 1-2(Sec. 1.1, 1.3, 1.3.4, 1.4, 1.5), 1-3(Sec. 2.2), Fig. 2-2, AP1-3, 4, 5, Table A5-10	The common name for all the radio equipment located at one and the same place used for serving one or several cells.	Referred from ITU-R M.1224
14	Bearer capability		Sec. 3.4, 5.1.2, 5.1.2.2, 5.1.2.3, Annex 3, 4	A transmission function which the mobile station requests to the network.	Referred from ITU-R M.1224
15	Bearer service		Annex 3, 6, Table A5-10	A type of telecommunication service that provides the capability for the transmission of information between user-network interfaces. NOTE 1 - The ISDN connection type used to support a bearer service may be identical to that used to support other types of telecommunication services.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
16	Billing		Sec. 3.3, 5.1.1.2, 5.1.8.1, 5.4, 7.1.1, 7.1.2.2, 7.1.2.2.2, Appendix 1(Sec. 2)	A function whereby charging information generated by the charging function is transformed into bills requiring payment. Billing also includes collecting payments from the subscribers.	Referred from ITU-R M.1224
17	Broadcast call		Sec. 5.1.8.4	A point-to-multipoint call in which the same information is transmitted simultaneously by the calling user to all intended users.	Referred from ITU-R M.1224
18	Call		Sec. 2.3, 3.3, 5.1*, 5.2, 5.3.2, 6.3*, 6.5.1, 7.1.2*, 8.5, 9.2*, 9.4.3, Annex 3, 7, Appendix 1(Sec. 1, 2, 5.3,5.4, 6), 1-3(Sec. 1.1, 2.1, 2.2), Table A5-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	The use, or possible use, of one or more connections set up between two or more users and/or services.	Referred from ITU-R M.1224
19	Call forwarding	CF	Sec. 3.3, Table A5-2, A5-8	A supplementary service or a service feature which allows the user to have his incoming calls addressed to another number.	Referred from ITU-R M.1224
20	Call hold	CH	Table A5-3	A supplementary service which allows a served mobile user to interrupt communication on an existing active call and then subsequently, if desired, re-establish communication.	Referred from ITU-R M.1224
21	Capability		Sec. 2.3, 3.4, 5.1*, 5.3.1, 5.3.2, 6.3.2.2.1, 6.3.2.3.1, 6.3.2.13, 7.1.1, 7.1.2.6, 9.2.2.1, Annex 3, 4, Appendix 1-2(Sec. 1.3.4), 1-3(Sec. 2.1), Table 6-1, A5-14	The ability of an item to meet a service demand of given quantitative characteristics under given internal conditions.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
22	Cell		Sec. 3.3, 4.2.2, 5.1.1.8.1, 5.1.8.1, 6.3*, 7.1.2.4, 7.1.2.5, 8.1, 9.2.1, 9.2.2.3, Annex 4, Appendix 1(Sec. 2, 5.4, 6), 1-1, 1-2(1.1, 1.2, 1.3.1), 1-3(Sec. 2.2)	The radio coverage area of a satellite spot beam or a base station, or of a subsystem (e.g. sector antenna) of that base station corresponding to a specific logical identification on the radio path, whichever is smaller. NOTE 1 - Every mobile station in a cell may be reached by the corresponding radio equipment.	Referred from ITU-R M.1224
23	Charging		Sec. 5.1.7, 5.1.8.1, 5.3.2, 5.4, 5.5, 7.1.1, 7.1.2.2, 7.1.2.2.2, 7.2.2, Annex 4, Appendix 1(Sec. 2), Table A5-6	A function, whereby information is gathered, recorded or transferred in order to make it possible to determine and to collate usage for which the subscriber may be billed.	Referred from ITU-R M.1224
24	Circuit transfer mode		Sec. 5.1.2.1, 5.1.2.2, 5.5, Annex 3, 4, Table A5-10	A transfer mode in which transmission and switching functions are achieved by permanent or quasi-permanent allocation of channels, bandwidth or codes between identified points of a connection.	Referred from ITU-R M.1224
25	Closed user group	CUG	Sec. 5.1.8.4, 6.3.1.2, Table A5-5	A supplementary service or a service feature which allows users to form groups to and from which access is restricted. A specific user may be a member of more than one CUG. Members of a specific CUG can communicate among themselves but not, in general, with users outside the group. NOTE 1 - Specific users of a CUG may have additional capabilities or additional restrictions that apply.	Referred from ITU-R M.1224
26	Common control channel	CCCH	Annex 4	A point-to-multipoint, bidirectional control channel. A CCCH is primarily intended to support signalling information for call control, mobility management and RF transmission management.	Referred from ITU-R M.1224
27	Compatibility		Sec. 2.1, 2.3, 3.1, 5.1.1.5.2, 6.1.3.1, 6.2.5.2, 6.3.2.2.2, 6.3.2.3.2, 6.3.2.7.4, Appendix 1(Sec. 1, 5.5)	A degree of transparency sufficient to support an acceptable grade of service with respect to a connection between system entities. Full compatibility implies full transparency.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
28	Conference calling	CON	Annex 3, Table A5-4	A supplementary service which allows the engagement of multiple parties in a single conversation.	Referred from ITU-R M.1224
29	Confidentiality		Sec. 6.5.2.4, 6.5.2.5, 6.5.2.6, 6.5.2.7	A property by which information relating to an entity or party is not made available or disclosed to unauthorized individuals, entities or processes.	Referred from ITU-R M.1224
30	Connectionless service		Sec. 3.4, 5.1.8.2	A service which allows the transfer of information among users without the need for end-to-end call establishment procedures. Connectionless services may be used to support both interactive and distribution services.	Referred from ITU-R M.1224
31	Contiguous coverage		Sec. 6.1.2	Coverage provided everywhere in the intended service area.	Referred from ITU-R M.1034
32	Conversational service		Sec. 5.1.1.7.2	An interactive service which provides bidirectional communication by means of real-time (no store-and-forward) end-to-end information transfer from user to user or between user and host.	Referred from ITU-R M.1224
33	Credit card calling	CCC	Sec. 7.1.2.2.2, Table A5-6	A supplementary service which allows the caller to have the call charged to the account specified by the CCC number.	Referred from ITU-R M.1224
34	Distribution service		Sec. 5.1.1.7, 5.1.1.7.3	A service characterized by the unidirectional flow of information from a given point in the network to the other (multiple) locations. Distribution service are subdivided into two classes: - without user individual presentation control; - with user individual presentation control.	Referred from ITU-R M.1224
35	Emergency service		Sec. 2.3, 3.3, 5.1.1.4, 5.1.8.1, 6.2.1.8, 9.2.1, Appendix 1(Sec. 2, 5.1, 5.7, 6), 1-3(Sec. 1.1, 2.2), Fig. AP1-1	A telecommunication service, which is used to access a public emergency centre, characterized by a locally significant access number, high priority, and distinctive feature interactions.	Referred from ITU-R M.1224
36	Encryption		Sec. 3.2, 6.2.2.5, 6.3.2.11, 7.1.2.3, 9.2.1, , Appendix 1(Sec. 5.5), Table A5-10	A function used to transform data so as to hide its information content to prevent it's unauthorized use.	Referred from ITU-R M.1224
37	End-user		Sec. 6.2, 6.3.2.3.4, 9.2.2, 9.2.2.4, Annex 4, 7(Sec. 1, 2)	The user of the 3G Mobile System terminal used to access the 3G Mobile System services.	Referred from ITU-R M.1034
38	Evolution		Sec. 2.3, 3.1, 6.3.2.7, 7.1.1	A process of change and development of a mobile radio system towards enhanced capabilities.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
39	Fixed public network		Sec. 3.1, 3.2, 9.2.1, 9.2.2.2	PSTN, PDN, ISDN and so on.	
40	Fixed station	FS	Sec. 9.2.2.1, 9.2.2.3, 9.3.5, 9.4.1, 9.4.3, 9.4.4, 9.4.6, Annex 3, 7(Fig. 1)	An equipment which terminates radio interface and is fixed.	
41	Forward link		Sec. 5.1.4.2, 5.1.4.3, 5.1.4.5, Annex 4, Appendix 1-1	A unidirectional radio pathway for the transmission of signals from one base station to one or more mobile stations. Same as downlink (terrestrial) in M.1224	Referred from ITU-R M.1224
42	FPLMTS		Sec. 1.1, 1.3, 7.2.4	Those systems that conform to the corresponding series of ITU Recommendations and Radio Regulations(now IMT-2000).	Referred from ITU-R M.1224
43	Frame		Sec. 5.5, 6.2.2.3, 6.3.3.3, 9.3.5, Appendix 1-2(Sec. 1.3.1, 1.3.4)	A block of variable length identified by a label at layer 2 of the OSI reference model, e.g. an HDLC block. NOTE 1 – The terms .glayer.h and .gHDLC.h refer to the OSI (Open Systems Interconnection) reference model.	Referred from ITU-R M.1224
44	Functional model		Sec. 7.2.3, Appendix 1(Sec. 3.2)	A model which identifies and defines functional entities and relationships between these functional entities.	Referred from ITU-R M.1224
45	Geostationary orbit	GSO	Sec. 4.2.4	The orbit of a geosynchronous satellite whose circular and direct orbit lies in the plane of the Earth's equator.	Referred from ITU-R M.1224
46	Global service area		Sec. 6.1.2	Worldwide service area.	Referred from ITU-R M.1224
47	Grade of service	GOS/GoS	Sec. 7.1.2.4	The proportion of calls that is lost or delayed due to congestion is a measure of the grade of service, or service provided.	
48	Handover		Sec. 5.1.1.8.1, 6.1.3.2, 6.3.2.*, 6.5.1, 7.1.2.1, 7.1.2.2.2, 7.1.2.4, 7.1.2.5, 7.1.2.6.2, 8.3, Table A5-9	The action of switching a call in progress from one cell to another (intercell) or between radio channels in the same cell (intracell) without interruption of the call. NOTE 1 - Handover is used to allow established calls to continue when mobile stations move from one cell to another (or as a method to minimize co-channel interference).	Referred from ITU-R M.1224
49	Highly inclined elliptical orbit	HEO	Sec. 4.2.4	An elliptical orbit most typically with a perigee of 500 km or more and a apogee of 50 000 km or less altitude above the Earth's surface with an inclination angle greater than 40.. from the equatorial plane.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
50	Home location register	HLR	Appendix 1(Sec. 3.2), Fig. AP1-3	The location database to which a mobile station is assigned for record purposes such as the service profile information of a subscriber or user.	Referred from ITU-R M.1224
51	Hot billing		Sec. 7.1.2.2.2	The ability to provide a complete and current bill for a customer on demand.	
52	Identification		Sec. 3.2, 3.3, 4.1.2, 5.1.7, 6.3.2.11, 7.1.2.2.1, 9.2.1, Appendix 1-1, 1-3(Sec. 2.2), Table A5-1, 10, 11	A step in a procedure used to identify a user or terminal to a service provider for the purposes of broad prevention.	Referred from ITU-R M.1224
53	IMT-2000		Sec. 1.1, 1.3, 2.1, 3.1, 3.4, 5.1.1.3, 5.3.2, Appendix 1(Sec. 3.1), Fig. 2-1	Those systems that conform to the corresponding series of ITU Recommendations and Radio Regulations(formerly FPLMTS).	Referred from ITU-R M.1224
54	Integration		Sec. 3.2, 6.3.2.14.1	The act or process or an instance of forming, coordinating, or blending into a functioning or unified whole.	Referred from ITU-R M.1224
55	Integrity		Sec. 2.3, 6.2.2.5, 9.2.1, Table 6-1	A property by which the information contents of an object is prevented from being modified.	Referred from ITU-R M.1224
56	Intelligent network	IN	Sec. 7.1.1, Appendix 1(Sec. 3.2)	A telecommunication network based on an architecture that provides flexibility for facilitating the introduction of new capabilities and services, including those under customer control.	Referred from ITU-R M.1224
57	Interworking		Sec. 2.3, 5.1.1.3, 5.1.5, 5.1.6, 6.3.2.4, 7.1.1, 7.1.2.2.4, 7.1.2.5, Appendix 1(Sec. 5.5), Table A5-9	The means of supporting communications and interactions between entities in different networks or systems.	Referred from ITU-R M.1224
58	Interactive service		Sec.5.1.1.7, 5.1.1.7.2, Annex 4	A service which provides the means for the bidirectional exchange of information between users or between users and hosts. NOTE 1 - Interactive services are subdivided into three classes of services: conversational services, messaging services and retrieval services.	Referred from ITU-R M.1224
59	Intercell handover		Sec. 6.3.2.3.3	(See "Handover".)	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
60	Interoperability		Sec. 6.5.1	The ability of multiple entities in different networks or systems to operate together without the need for additional conversion or mapping of states and protocols.	Referred from ITU-R M.1224
61	Interworking functions		Sec. 5.1.1.3, 5.1.5, 5.1.6, 6.3.2.4	Mechanisms which mask the differences in physical, link, and network technologies by converting or mapping states and protocols into consistent network and user services.	Referred from ITU-R M.1224
62	Intracell handover		Sec. 6.3.2.3.3	(See "Handover".)	Referred from ITU-R M.1224
63	Island coverage		Sec. 6.1.2	Collection of cells which may range in coverage from a neighbourhood to a major urban area.	Referred from ITU-R M.1034
64	Limited service area		Sec. 6.1.2	A service area which is limited to a part of a country.	Referred from ITU-R M.1224
65	Location confidentiality		Sec. 6.5.2.7	A function by which the information about the location of an entity is accessible only to the authorized parties.	Referred from ITU-R M.1224
66	Location management		Sec. 7.1.2.2.2	The function to perform the evaluation with regard to location updating signal traffic. This evaluation makes it possible to change the location area so as to optimize the total load of location updating control.	
67	Location service		Sec. 5.1.1.7.1, 5.1.8.1, 5.5, 6.3.2.11, Appendix 1(Sec. 1, 2, 3*, 4, 5*, 6), 1-1, 1-2(Sec. 1.5), Fig. AP1-1, 2	A particular mobility service in which location information can be provided to authorized users or to relevant authorities in case of emergency calls or for vehicular traffic management.	Referred from ITU-R M.1224
68	Low-Earth orbit	LEO	Sec. 4.2.4	A circular or elliptical orbit of about 700 to 3 000 km altitude above the Earth's surface.	Referred from ITU-R M.1224
69	Macro cells		Sec. 4.2.2	Cells with a large cell radius, typically several tens of km. (Radius of 35 km.) NOTE 1 - The radius of a cell can be extended by the use of directional antennas. NOTE 2 - Macro cells are characterized by low-to-medium traffic density, support for moderate mobile station speeds and narrow band services. NOTE 3 - A typical macro cell may be situated in a rural or suburban environment, with moderate building blockage, and, depending on terrain, significant foliage blockage.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
70	Malicious call identification	MCI	Table A5-1	A supplementary service which allows the user to request that the source of an incoming call be identified and presented to an authorized entity.	Referred from ITU-R M.1224
71	Messaging service		Sec. 5.1.1.7.2, 5.1.8.2, 5.5, Annex 4, 7(Sec. 7)	An interactive service which offers user-to-user communication between individual users via storage units with store-and-forward, mailbox and/or message handling (e.g. information editing, processing and conversation) functions.	Referred from ITU-R M.1224
72	Micro cells		Sec. 4.2.2, 5.1.8.1, Appendix 1(Sec. 2)	Cells with low antenna sites, predominantly in urban areas, with a typical cell radius of up to 1 km. NOTE 1 - Micro cells are characterized by medium-to-high traffic density, low mobile station speeds and narrow-band services. NOTE 2 - Blockage by man-made structures may be significant in a micro cell environment.	Referred from ITU-R M.1224
73	Mobile earth station	MES	Sec. 4.1.2.10, 4.1.2.11, 4.1.2.12, 4.1.2.13, 8.1, Fig. 8-1	An entity capable of accessing a set of 3G Mobile System satellite services. This entity may be stationary or in motion within the 3G Mobile System service area while accessing 3G Mobile System satellite services and may simultaneously serve one or more user. NOTE 1 - A user of a mobile earth station may also have several simultaneous connections with the network.	Referred from ITU-R M.1224
74	Mobile services switching centre	MSC	Sec. 9.2.2.1, Annex 7, Appendix 1(Sec. 3.2), Fig. 2-2, AP1-2, 3, Table A5-9	In an automatic system, the MSC constitutes the interface between the radio system and the public switched telephone network. The MSC performs all necessary signalling functions in order to establish calls to and from mobile stations.	Referred from ITU-R M.1224
75	Mobile station	MS	Sec. 2.4, 3.2, 3.3, 4.1.*, 4.2.1, 5.1.8.2, 5.1.8.3, 6.1, 6.2*, 6.3*, 9.2.2.1, 9.2.2.3, Annex 2, 4, 7, Appendix 1(Sec. 1, 4, 5.1, 5.3, 5.4, 6), 1-2(Sec. 1.1, 1.3, 1.3.4), 1-3(Sec. 2.2), Table A5-2,5,9,10,11, 12, 13, Fig. 2-2, AP1-2, 3, 4, 5	A station in the mobile service intended to be used while in motion or during halts at unspecified points.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
76	Mobile terminal		Sec. 2.1, 3.1, 3.4, 5.1.1.4, 5.3.2, 6.3.2.8.3, 6.5.1, 7.1.2.5, Appendix 1(Sec. 3.1, 4)	A portable terminal providing the capability for the user to be either stationary or in motion while accessing and using telecommunication services.	Referred from ITU-R M.1224
77	Mobile termination	MT	Sec. 3.3	The part of the mobile station which terminates the radio path at the mobile side and adapts the capabilities of the radio path to the capabilities of the terminal equipment.	Referred from ITU-R M.1224
78	Mobility management	MM	Sec. 9.4.7	A function in the layer 3 which carries out registration and authentication for the mobile station. NOTE 1 - The term "layer" refers to the OSI (Open Systems Interconnection) reference model.	Referred from ITU-R M.1224
79	Mobility service		Sec. 5.1.1.7, 5.1.1.7.1, 9.2.1	Services which are directly related to the mobility of a user including terminal mobility.	Referred from ITU-R M.1224
80	Multimedia service		Sec. 2.3, 3.4, 5.1.5	A service in which the interchanged information consists of more than one type (e.g. video, data, voice, graphics). Multimedia services have multivalued attributes which distinguish them from traditional telecommunication services such as voice or data. A multimedia service may involve multiple parties, multiple connections, the addition/deletion of resources and users within a single communication session. NOTE 1 - In 3G Mobile System specifications or reports, multimedia is used in the sense of multiple information types supported within what the user sees as a single call.	Referred from ITU-R M.1224
81	National service area		Sec. 6.1.2	A service area consisting of a single country.	Referred from ITU-R M.1224
82	Network		Sec. 1*, 2*, 3*, 4*, 5*, 6*, 7*, 8*, 9*, Annex 2, 3, 4, 5, 7(Sec. 1, 2, 3, 7), Appendix 1(Sec. 1,2, 3.1, 3.2,5.4,6), 1-3(Sec. 2.2), Table 6-1, A5-1, 2, 3, 9, 11, 12, 13, 14	A set of nodes and links that provides connections between two or more defined points to facilitate telecommunication between them.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
83	Network architecture		Sec. 1.3, 7.1.2	A network configuration which identifies and defines physical entities and physical interfaces between these physical entities.	Referred from ITU-R M.1224
84	Network operator		Sec. 3.2, 3.4, 5.1.1.5.2, 6.3.2, 6.3.2.5.1, 6.5.1, 6.5.2.8, 7.1.2, 7.1.2.2.2, 7.1.2.2.3, 7.1.2.6, 7.2.2, Table A5-12	A provider of network capabilities needed to support the services offered to subscribers.	Referred from ITU-R M.1224
85	Packet		Sec. 2.3, 3.4, 5.1.1.6, 5.1.1.8.3, 5.1.2.1, 6.2.1.5, 6.3.2.4, Annex 4, Table 6-1	An information block identified by a label at layer 3 of the OSI reference model. NOTE 1 - The term "layer" refers to the OSI (Open Systems Interconnection) reference model.	Referred from ITU-R M.1224
86	Packet transfer mode		Sec. 5.1.1.8.3, 5.1.2.3, 5.1.4.2, 5.5, Annex 3, 4, Table A5-10	A transfer mode in which the transmission and switching functions are achieved by packet oriented techniques, so as to dynamically share network transmission and switching resources between a multiplicity of connections.	Referred from ITU-R M.1224
87	Paging		Sec. 2.3, 3.2, 3.4, 4.1.1.1, 4.1.2.13, 5.1.8.3, 5.5, 7.1.2.4, 8.1, Annex 4, Table 6-1, A5-2, A6-1	Paging is the non-speech, one-way, selective transfer of a simple alert message (e.g. tone only) or a message (e.g. numeric, alphanumeric or transparent data) to a mobile receiver or pager. NOTE 1 - The feature "Paging with Acknowledgement" is also possible.	Referred from ITU-R M.1224
88	Path		Sec. 4.1.2, 4.2, 4.2.1, 4.2.2, 4.2.3, 4.2.4, 5.1.4.2, 9.2.1.Annex 7(Sec. 3), Appendix 1-1	The continuous series of positions or configurations of a mobile radio system that can be assumed in the process of change when moving towards a 3G Mobile System.	Referred from ITU-R M.1224
89	Personal communications service	PCS	Sec. 4.3, (Appendix 1-3(Sec. 1.1)	A set of capabilities that allows some combination of terminal mobility, personal mobility, and service profile management. NOTE 1 – The acronym PCS should be taken to refer to personal communication services.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
90	Personal mobility		Sec. 5.3.3	The ability of a user to access telecommunication services at any terminal on the basis of a personal telecommunication identifier, and the capability of the network to provide those services according to the user's service profile. NOTE 1 - Personal mobility involves the network capability to locate the terminal associated with the user for the purposes of addressing, routing, and charging of the user's calls. NOTE 2 - The word "access" is intended to convey the concepts of both originating and terminating services. NOTE 3 - Management of the service profile by the user is not part of personal mobility.	Referred from ITU-R M.1224
91	Personal terminal		Sec. 6.2.1.11	A light-weight, small, portable terminal providing the capability for the user to be either stationary or in motion while accessing and using telecommunication services.	Referred from ITU-R M.1224
92	Power control		Sec. 6.2.4, Appendix 1(Sec. 5.3)	Dynamic adjustment of the output power to minimise the total interference in the system, while maintaining sufficient quality of any connection.	Referred from ITU-R M.1034
93	Privacy		Sec. 5.1.1.2, 5.1.1.7.1, 5.1.7, 5.1.8.1, 5.2, 5.5, 6.3.2.11, 6.5, 6.5.1, 6.5.2, 6.5.2.4, 6.5.2.7, Appendix 1(Sec. 5.5, 5.6), Table A5-10	The right of individuals to control or influence what information related to them may be collected and stored and by whom and to whom that information may be disclosed. NOTE 1 - National laws may apply in matters dealing with the protection of privacy.	Referred from ITU-R M.1224
94	Private numbering plan	PNP	Table A5-5	A service feature allowing the subscriber to maintain a numbering plan within his private network, which is separate from the public numbering plan.	Referred from ITU-R M.1224
95	Public land mobile network	PLMN	Sec. 5.1.1.3, 5.1.3.1, 6.4, 7.1.1, Annex 3, 4, Table 6-1, A5-8, 11, 14	A network established and operated by an administration or Recognized Operating Agency (ROA) for the specific purpose of providing land mobile telecommunication services to the public. A PLMN may be regarded as an extension of a fixed network (e.g. PSTN) or as an integral part of the PSTN. NOTE 1 – A PLMN may comprise terrestrial cells or a combination of terrestrial and satellite cells	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
96	Quality of service	QoS	Sec. 3.1, 3.4, 5.1.* 6.2.2, 6.3.*, 6.4, 7.1.2.4, 9.2.1, Annex 3, 4	The collective effect of service performances which determine the degree of satisfaction of a user of a service. It is characterized by the combined aspects of performance factors applicable to all services, such as: - service operability performance, - service accessibility performance, - service retainability performance, - service integrity performance, - other factors specific to each service.	Referred from ITU-R M.1224
97	Radio-frequency(RF) channel		Sec. 2.3, 6.2.2.2, 6.3.2.3.4, 6.3.2.5.3, 6.3.3.3, 6.3.3.4, 8.9, Annex 3, Table A5-2, 9	A specified portion of the RF spectrum with a defined bandwidth and a carrier frequency and is capable of carrying information over the radio interface.	Referred from ITU-R M.1224
98	Radio interface		Sec. 1.3, 3.2, 3.3, 4.1.*, 6.1*, 6.2*, 6.3*, 6.5.*, 9.2.1, Annex 2, 3, 6	The common boundary between the mobile station and the radio equipment in the network, defined by functional characteristics, common radio (physical) interconnection characteristics, and other characteristics, as appropriate. NOTE 1 - An interface standard specifies the bidirectional interconnection between both sides of the interface at once. The specification includes the type, quantity and function of the interconnecting means and the type, form and sequencing order of the signals to be interchanged by those means. The term "air interface" is synonymous with the term "radio interface". See also "3G Mobile System radio interface".	Referred from ITU-R M.1224
99	Radio interface protocol		Sec. 7.1.2.5	The protocol used across the radio interface (usually a collection of protocols supporting various layers of the protocol reference model).	Referred from ITU-R M.1224
100	Radio network controller	RNC	Annex 7(Sec. 1)	A node which controls radio resources.	
101	Radio resource		Fig. AP1-3, Table A5-2	A radio resource is a portion of spectrum available in a limited geographical area (cell). This portion of spectrum can be further divided into radio-frequency channels	Referred from ITU-R M.1224
102	Regional service area		Sec. 6.1.2	A service area that covers several countries and/or ocean regions of comparable size.	Referred from ITU-R M.1224
103	Registration		Sec. 7.1.2.4, Appendix 1(Sec. 4), Fig. AP1-3, Table A5-2, 14	A process by which a 3G Mobile System network becomes aware of the existence and location of a terminal and its associated user.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
104	Reverse link		Sec. 5.1.4.2, 5.1.4.3, 5.1.4.5, Annex 3, 4, Appendix 1-1	A unidirectional radio pathway for the transmission of signals from one or more mobile stations to one base station. Same as uplink (terrestrial) in M.1224	Referred from ITU-R M.1224
105	Roaming		Sec. 2.3, 3.1, 3.3, 3.4, 5.1.1.1, 5.1.1.2, 5.1.1.3, 6.1.3.2, 6.2.1.10, 6.3.*,6.5.1, 7.1.1, 9.2.2.3, Appendix 1(Sec. 5.4), 1-3(Sec. 2.2),Table A5-8, 9, 14	The ability of a user to access wireless telecommunication services in areas other than the ones where the user is subscribed.	Referred from ITU-R M.1224
107	Security		Sec. 1.3, 2.3, 3.2, 3.3, 5.1.1.2, 5.1.7, 5.1.8.1, 5.2, 5.5, 6.5, 6.5.1, 6.5.2, 6.5.2.11, 7.1.1, 7.1.2.3, 9.2.1, Annex 4, Appendix 1(Sec. 1, 2, 5.6), 1-3(Sec. 1.1), Table A5-10	The protection of information availability, integrity and confidentiality.	Referred from ITU-R M.1224
108	Security feature		Sec. 6.5.1, 7.1.2.3	A feature that gives some assurance against one or several potential security threats.	Referred from ITU-R M.1224
109	Security management		Sec. 7.1.2.3, 7.2.2, 9.4.6	The handling of the network and service management aspects of security, including administrative, operational and maintenance issues.	Referred from ITU-R M.1224
110	Security mechanism		Sec. 6.5.1, 7.1.2.3	A means of providing a security feature.	Referred from ITU-R M.1224
111	Service		Sec. 1*, 2*, 3*, 4*, 5*, 6*, 7*, 8*, 9*, Annex 2, 3, 4, 5, 6, 7(Sec. 1, 2, 7), Appendix 1(Sec. 1, 2, 3.2, 4, 5.*, 6), 1-3(Sec. 1, 1.1, 2.2), Fig. AP1-3, Table 5-1, 6-1, A5-*, A6-1	A set of functions offered to a user by an organization.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
112	Service access point	SAP	Appendix 1(Sec. 5.5)	An access point at which the layer (N – 1) provides the (N – 1) services to (N) entities.	Referred from ITU-R M.1224
113	Service area		Sec. 5.1.4.4, 5.6, 6.1.2, 6.2.1.10, 9.2.2.1, Appendix 1(Sec. 4)	The area within which a mobile station can access the 3G Mobile System services. A service area may consist of several 3G Mobile System networks. One service area may consist of one country, be a part of a country or comprise of several countries.	Referred from ITU-R M.1224
114	Service availability		Sec. 3.4, 6.3.2.1.1	An availability to a set of service capabilities offered to a user by an organization/3G Mobile System service provider.	
115	Service feature		Sec. 5.1.1.7, 5.5, Table A5-14	A network function associated with a particular basic or supplementary service in order to upgrade such services in the interest of higher comfort to the users but, in general, not offered to them as a service on its own.	Referred from ITU-R M.1224
116	Service node	SN	Sec. 9.2.2.2, Annex 7(Sec. 1, 2, 3)	A node which controls services and resources.	
117	Service profile		Sec. 5.1.1.8.4, 5.2, 6.5.2.1, 6.5.2.10	A record containing information related to a user in order to provide that user with 3G Mobile System services.	Referred from ITU-R M.1224
118	Service provider		Sec. 3.2, 6.3.2.11, 6.3.2.12, 6.5.1, 6.5.2.8, 7.1.2*, 7.2.2, Annex 4, Appendix 1(Sec. 3.1, 5.5), Fig. AP1-2, Table A5-9, 12	A person or an other entity that has the overall responsibility for the provision of a service or a set of services to the users and for negotiating network capabilities associated with the services he/she provides.	Referred from ITU-R M.1224
119	Short message		Sec. 5.1.8.2, 5.5, Annex 4, 7(Sec. 7), Table 6-1, A6-1	An information block transferred as a whole by means of the Short Message Service.	Referred from ITU-R M.1224
120	Signalling information confidentiality		Sec. 6.5.2.5	Bit series which indicate the top and last flags of the message, the number of units remaining in the message and the number of valid octets in the last unit and used for disassembly and assembly of messages.	Referred from ITU-R M.1224
121	Spot coverage		Sec. 6.1.2	Single cell.	Referred from ITU-R M.1034

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
122	Subscriber		Sec. 4.1.1.1, 4.1.2.8, 5.1.1.8.4, 5.1.7, 5.1.8.1, 6.3.2.12, 6.5.2.1, 7.1.2.*, 9.1, 9.2.1, 9.2.2.1, 9.4.1, Annex 7(Sec. 1), Appendix 1(Sec. 1, 2, 3.2), 1-3(Sec. 1.1), Fig. AP1-1, Table A5-1, 2, 3, 5, 8, 9, 10, 11, 14, 15	A person or other entity that 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.) NOTE 1 - Sometimes the term "3G Mobile System subscriber" is used interchangeably with "subscriber", especially where it is necessary to distinguish a person or organization which subscribes directly to a 3G Mobile System service from one which benefits from 3G Mobile System services.	Referred from ITU-R M.1224
123	Subscriber access to service profile		Sec. 6.5.2.10	A feature by which the 3G Mobile System subscriber has direct and limited access to the personal service profile of his associated users, by means of which he may be able to restrict access to services, etc.	Referred from ITU-R M.1224
124	Supplementary service		Sec. 5.1.7, 5.5, Annex 5(*), Table A5-1, 2, 3, 4, 5, 6 ,7, 8, 10, 13, 14	A service which modifies or supplements a basic telecommunication service. Consequently, it can not be offered to a customer as a standalone service, rather, it must be offered together with or in association with a basic telecommunication service. The same supplementary service may be common to a number of telecommunication services.	
125	System		Sec. 1*, 2*, 3*, 4*, 5*, 6*, 7*, 8.10, 9*, Annex 3, 4, 5, 6, 7(Sec. 1, 2, 3, 7), Appendix 1(Sec. *), 1-1, 1-2(Sec. 1.3.4, 1.4), 1-3(Sec. 1.1, 2.2), Fig. 2-2, Table 6-1, A5-2, 5, 10, 13, AP1-2	A regularly interacting or interdependent group of items forming a unified whole technology.	Referred from ITU-R M.1224
126	Telecommunication management network	TMN	Sec. 1.3, 7.1.2.4, 7.2.1, 7.2.2, 7.2.3, 7.2.4	A network supposed to support the management requirements of an operator (e.g. service provider, network provider, backbone network provider, access provider) to plan, provision install, maintain, operate and administer telecommunications and services.	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
127	Telephone service		Sec. 5.1.3.1, 5.1.4.1, 6.2.3, 9.2.1, 9.2.2.1, 9.3.1, Annex 3	A public telecommunication service primarily intended for the exchange of information in the form of speech, whereby users can communicate directly and temporarily between themselves in conversational mode, and should be provided in accordance with the International Telecommunication Regulations, and the relevant ITU-T Recommendations. NOTE 1 - The international telephone service can also support a number of non-voice services such as facsimile and data transmission.	Referred from ITU-R M.1224
128	Teleservice		Sec. 6.1.1	A type of telecommunication service that provides the complete capability, including terminal equipment functions, for communication between users according to protocols established by agreement between administrations and/or ROAs.	Referred from ITU-R M.1224
129	Terminal		Sec. 1.3, 2.1, 2.3, 3.2, 3.4, 4.1.2.11, 4.3, 5.1.*, 5.3.*, 6.2.*, 7.1.2.1, 7.1.2.6, 9.2.*, 9.3.2, 9.4.1, 9.4.2, Annex 7(Sec. 1, 3, 7), Appendix 1(Sec. 2, 3.1), 1-1, Table A5-2, 8, 9, 10, 11	The equipment which interfaces the end user with 3G Mobile System.	Referred from ITU-R M.1224
130	Terminal equipment	TE	Sec. 3.2, 9.2.1, 9.2.2.2, Annex 7(Sec. 1, 2)	An equipment which interfaces the end user.	
131	Terminal mobility		Sec. 2.3, 5.1.1.7.1, 5.3.1, 5.3.3	The ability of a terminal to access telecommunications services from different locations and while in motion, and the capability of the network to identify and locate that terminal or the associated subscriber. NOTE 1 - This ability implies the availability of telecommunication services, ideally, in all areas and at all times. Terminal mobility may be provided according to the mobile terminal's service profile.	Referred from ITU-R M.1224
132	TMN management service		Sec. 7.2.1, 7.2.2, 7.2.3, 7.2.4	An area of management activity which provides for the support of operations, maintenance or administration of the network being managed, described from the user perception of the OAM requirements	Referred from ITU-R M.1224

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
133	Traffic capacity		Sec. 4.1.2.10	The total traffic that can be supported by a single cell (or spot beam), which is part of an infinite set of identical cells (or large number of satellite spot beams) in a uniform two-dimensional (or three-dimensional) pattern. NOTE 1 - The traffic capacity must be specified at a stated spectrum allocation, quality and grade of service, assuming an appropriate propagation model. This metric, is measured in Erlang/cell or Erlang/satellite spot beam, and is valuable for comparing systems with identical user channel requirements.	Referred from ITU-R M.1224
134	Traffic channel	TCH	Annex 3, 7(Sec. 6), Table A5-3, 9	A point-to-point bidirectional channel which transfers user information and the user information control signal. The TCH transfers voice and facsimile information.	Referred from ITU-R M.1224
135	Transmission performance		Sec. 1.3, 5.1.1.8, 6.2.2.3	The reproducibility of a signal input to a telecommunications network under given conditions. The given conditions may include the effect of propagation performance where applicable.	Referred from ITU-R M.1224
136	UIM holder verification		Sec. 6.5.2.3	A feature by which the human user of the UIM is authenticated. This feature only applies when the UIM is used for the user association with the 3G Mobile System mobile terminals.	Referred from ITU-R M.1224
137	Universal personal telecommunications	UPT	Sec. 1.3, 3.4, 5.1.1.7.1, 5.3.3, 7.1.1, 7.1.2.2	UPT enables access to telecommunication services while allowing personal mobility. It enables each UPT user to participate in a user-defined set of subscribed services and to indicate and receive calls on the basis of a personal, network-transparent UPT number across multiple networks on any fixed or mobile terminal, irrespective of geographical location, limited only by terminal and network capabilities and restriction imposed by the network operator.	Referred from ITU-T F.851
138	UPT number		Sec. 5.3.3	A number that uniquely identifies a UPT user, it is also used by a calling party to reach that UPT user. A UPT user may have more than one UPT number (for example, a business UPT number for business calls and a private UPT number for private calls). (ITU-T F.851)	Referred from ITU-T F.851

No.	Term	Abbrev.	Section(s)	Descriptions	Comment
139	User		Sec.1.1, 2*, 3*, 4*, 5*, 6*, 7*, 8*, 9*, Annex 3, 4, 6, 7(Sec. 1, 2, 3, 5), Appendix 1(Sec. 1, 2, 5.4, 5.5, 6), 1-1, 1-3(Sec. 1.1), Table 6-1, A5-1, 2, 3, 4, 5, 6, 7, 11, 12, 13, 14	A person or other entity authorized by a subscriber to use some or all of the services subscribed to by that subscriber.	Referred from ITU-R M.1224
140	User identification		Sec. 3.3, 7.1.2.2.1, 9.2.1	The process which enables an IT system to recognize a user as corresponding to one previously described to the system.	Referred from ITU-R M.1224
141	User identity module	UIM	Sec. 5.1.1.4, 5.3.2, 6.3.2.11, 6.5.1, 6.5.2.3, 9.2.2.3, Appendix 1(Sec. 5.4)	In 3G Mobile System it is a logical entity which could be removable from a unit (mobile or fixed) or with functionality contained in a unit. It contains information elements needed by the system to identify, authenticate and permit the users registration. The UIM can also be used to store user specific data.	Referred from ITU-R M.1224
142	Visitor location register	VLR	Appendix 1(Sec. 3.2), Fig. AP1-3	The location database, other than the home location register (HLR), used by an MSC to retrieve information for, for instance, handling of calls to or from a roaming mobile station, currently located in its area.	Referred from ITU-R M.1224
143	Wireless access		Sec. 1.1, 6.3.2.5.7, 9	A terminal access to the network which uses wireless technology.	Referred from ITU-R M.1224

1. Acronyms

No.	Abbreviation(s)	Term	Section(s)	Comment
1.	AMSC	Anchor mobile services switching center	Annex 7(Sec. 3)	
2.	AOA	Angle of arrival	Sec. 6.3.2.11, Appendix 1(Sec. 3.1, 4, 5.2), 1-1, 1-2(Sec. 1.1, 1.5) , Fig. AP1-2	
3.	AoC	Advice of charge	Table A5-6	Referred from ITU-R M.1224
4.	ARIB	Association of Radio Industries and Businesses (formerly RCR)	Sec. 1.1	
5.	B-ISDN	Broadband ISDN	Sec. 5.1.1.5, 7.1.1, 7.1.2.2.4	Referred from ITU-R M.1224
6.	BER	Bit error ratio	Sec. 5.1.4.1, 5.1.4.2, 6.3.3.3, 6.4, 9.4.2, Annex 3, 4, Table 6-1	Referred from ITU-R M.1224
7.	BS	Base station	Sec. 9.2,2,2, Annex 7(Sec. 1, 2, Fig.1), Appendix 1(Sec. 3.2), 1-1, 1-2(Sec. 1.3, 1.3.4), Fig. 2-2, AP1-2, 4, 5	
8.	CCITT	International Telegraph and Telephone Consultative Committee (now ITU-T)	Sec. 5.1.3.1, Table A5-13	Referred from ITU-R M.1224
9.	CDMA	Code division multiple access	Appendix 1(Sec. 5.3), 1-1, 1-2(Sec. 1.3.1, 1.3.4, 1.5)	Referred from ITU-R M.1224
10.	CS	Cell station	Sec. 8.1, Fig. 8-1	
11.	CUG	Closed user group	Table A5-5	Referred from ITU-R M.1224
12.	DS	Direct Sequence	Appendix 1-1	Referred from ITU-R M.1224
13.	DTMF	Dual tone multiple frequency	Sec. 9.3.2, Annex 7(Sec. 5), Table A5-13	Referred from ITU-R M.1224
14.	EMC	Electromagnetic compatibility	Sec. 3.1, 6.2.5.2	Referred from ITU-R M.1224
15.	FDD	Frequency division duplex	Sec. 4.3	Referred from ITU-R M.1224
16.	FER	Frame error ratio	Sec. 6.3.3.3	
17.	FES	Fixed earth station	Sec. 8.11	
18.	FPLMTS	Future Public Land Mobile Telecommunication Systems	Sec. 1.1, 1.3, 7.2.4	Referred from ITU-R M.1224
19.	FS	Fixed station	Sec. 9.2.2.1, 9.2.2.3, 9.4.1, 9.4.3, Annex 3, 7(Sec. 3, 7, Fig. 1)	
20.	FSS	Fixed satellite service	Sec. 8.11	Referred from ITU-R M.1224

No.	Abbreviation(s)	Term	Section(s)	Comment
21.	FWA	Fixed wireless access	Sec. 5.1.7, 6.3.2.5.7, 9, 9.1, 9.2.*, 9.3*, 9.4.*, Annex 7(Sec. 1, 2, 3, 7), Table A5-1, 2, 3, 6, 8, 10, 11, 12, 14	
22.	GDMO	Guidelines for the definition of managed objects	Sec. 7.2.4	Referred from ITU-R M.1224
23.	GOS/GoS	Grade of service	Sec.7.1.2.4	
24.	GPS	Global positioning system	Appendix 1(Sec. 3.1), 1-1	Referred from ITU-R M.1224
25.	GSO	Geostationary satellite orbit	Sec. 4.2.4	Referred from ITU-R M.1224
26.	HEO	Highly inclined elliptical orbit	Sec. 4.2.4	Referred from ITU-R M.1224
27.	HLR	Home location register	Appendix 1(Sec. 3.2), Fig. AP1-3	Referred from ITU-R M.1224
28.	IMT	International mobile telecommunication	Sec. 1.1, 1.3, 2.1, 3.1, 3.4, 5.1.1.3, 5.3.2, Appendix 1(Sec. 3.1)	Referred from ITU-R M.1224
29.	IN	Intelligent network	Sec. 7.1.1, Appendix 1(Sec.3.2)	Referred from ITU-R M.1224
30.	IP	Internet protocol	Sec. 5.1.1.6, 5.1.1.8.3, 5.1.4, 5.1.4.2, Appendix 1(Sec5.5), Annex 4	
31.	ISDN	Integrated services digital network	Sec. 1.1, 2.1, 2.3, 3.1, 5.1.1.*, 5.1.2.2, 5.1.7, 6.2.2.4, 7.1.1, 7.1.2.2.4, 9.2.2.4, 9.3, 9.3.4, Annex 3, 4, 5, 6, Table 6-1, A5-1, 9, 10	Referred from ITU-R M.1224
32.	ISO	International Organization for Standardization	Sec. 7.2.4	Referred from ITU-R M.1224
33.	ITU	International Telecommunication Union	Sec. 1.1, 1.3, 5.15	Referred from ITU-R M.1224
34.	ITU-R	International Telecommunication Union-Radio Communications Sector	Sec. 1.3, 4.1.2, 4.2, 5.1.1.5.2, 6.1.1.8, 6.2, 6.2.2.1, 6.3.*, 9.1, 9.2.1, Annex 3, 7(Sec. 1, 2), Table 4-1	
35.	ITU-T	International Telecommunication Union-Telecommunication Standardization Sector	Sec. 1.3, 2.3, 3.1, 3.2, 3.3, 5.1.1.*, 5.1.6, 5.3.3, 6.2, 6.2.2.1, 6.2.2.4, 7.2.*, 8.2, 9.2.1, 9.3.1, Annex 3	Referred from ITU-R M.1224
36.	IWF	Interworking function	Sec. 5.1.5, 5.1.6, Annex 3, 4	Referred from ITU-R M.1224
37.	LEC	Local exchange carrier	Appendix 1-3(Sec. 1.1)	Referred from ITU-R M.1224
38.	LEO	Low-earth orbit	Sec. 4.2.4	Referred from ITU-R M.1224
39.	LOS	Line-of-sight (path)	Sec. 4.2.1, Appendix 1-1	Referred from ITU-R M.1224
40.	MES	Mobile earth station	Sec. 8.1, Fig. 8-1	Referred from ITU-R M.1224
41.	MOS	Mean opinion score	Sec. 6.2.2.1, Annex 3	Referred from ITU-R M.1224

No.	Abbreviation(s)	Term	Section(s)	Comment
42.	MPEG	Moving Picture Expert Group	Sec. 5.1.4.1, Annex 3, 4	
43.	MPT	Ministry of Posts and Telecommunications	Sec. 1.3, 4.3	
44.	MS	Mobile station	Sec. 5.1.8.3, 6.3.2.11, 9.2.2.1, 9.2.2.3, Annex 4, Appendix 1(Sec. 5.3, 5.4, 6), 1-2(Sec. 1.1, 1.3, 1.3.4), 1-3(Sec. 2.2), Table A5-2, 5, 9, 10, 11, 12, Fig. 2-2, AP1-2, 3, 4, 5	Referred from ITU-R M.1224
45.	MSC	Mobile services switching centre	Sec. 9.2.2.1, Annex 7(Sec. 1, 3, 7), Appendix 1(Sec. 3.2), Fig. 2-2, AP1-2, 3Table A5-9	Referred from ITU-R M.1224
46.	MTBF	Mean time between failure	Sec. 6.3.3.5, 9.2.1	
47.	MTM	Multipoint to multipoint	Annex 4	
48.	MTP	Multipoint to point	Annex 4	
49.	O&M	Operations and maintenance	Sec. 7.1.2	Referred from ITU-R M.1224
50.	OSI	Open Systems Interconnection	Sec. 7.1.1	Referred from ITU-R M.1224
51.	PABX	Private automatic branch exchange	Sec. 3.2	Referred from ITU-R M.1224
52.	PCS	Personal communications service	Sec. 4.3, Appendix 1-3(Sec. 1.1)	Referred from ITU-R M.1224
53.	PDN	Public data network	Sec. 3.1	Referred from ITU-R M.1224
54.	PES	Personal earth station	Sec. 8.1, 8.7, Fig. 8-1	Referred from ITU-R M.1224
55.	PHS	Personal handyphone system	Sec. 4.3, Appendix 1-1	
56.	PLMN	Public land mobile network	Sec. 5.1.1.3, 5.1.3.1, 6.4, 7.1.1, Annex 3, 4, Table 6-1, A5-8, 11, 14	Referred from ITU-R M.1224
57.	PS	Personal station	Sec. 8.1, 8.7, Fig. 8-1	Referred from ITU-R M.1224
58.	PSTN	Public switched telephone network	Sec. 1.1, 1.3, 2.1, 2.3, 3.1, 5.1.1.*, 5.1.5, 6.2.1.11, 6.2.2.4, 7.1.1, 7.1.2.2.4, 9.2.2.1, 9.3, Annex 3, 4, 7(Sec. 3), Table 6-1	Referred from ITU-R M.1224
59.	PTM	point to multipoint	Annex 3, 4	
60.	PTP	point to point	Annex 3, 4	
61.	QCIF	Quarter Common Intermediate Format	Sec. 5.1.4.1, Annex 4	

No.	Abbreviation(s)	Term	Section(s)	Comment
62.	QoS	Quality of service	Sec. 5.1.1.8, 5.1.1.8.1, 5.1.1.8.3, 5.1.2.3, 5.1.4, 5.1.8.3, 6.4, 7.1.2.4, Annex 3, 4	Referred from ITU-R M.1224
63.	RF	Radio frequency	Sec. 5.1.1.5.2, 6.2.2.3, 6.2.5.1	Referred from ITU-R M.1224
64.	RFTR	Radio frequency transmission and reception	Fig. AP1-3	Referred from ITU-R M.1224
65.	RNC	Radio network controller	Annex 7	
66.	RRC	Radio resource control	Fig. AP1-3	Referred from ITU-R M.1224
67.	SCF	Service control function	Fig. AP1-3	Referred from ITU-R M.1224
68.	SP	Satellite pager	Sec. 8.1, Fig. 8-1	Referred from ITU-R M.1224
69.	SSF	Service switching function	Fig. AP1-3	Referred from ITU-R M.1224
70.	TDD	Time division duplex	Sec. 4.3	Referred from ITU-R M.1224
71.	TDOA	Time difference of arrival	Sec. 6.3.2.11, Appendix 1(Sec. 3.1, 4, 5.2), 1-1, Fig. AP1-2	
72.	TE	Terminal Equipment	Annex 7(Sec. 1, 2)	
73.	TMN	Telecommunication management network	Sec. 1.3, 7.1.2.4, 7.2.1, 7.2.2, 7.2.3, 7.2.4	Referred from ITU-R M.1224
74.	TOA	Time of arrival	Sec. 6.3.2.11, Appendix 1(Sec. 3.1, 4, 5.2), 1-1, 1-2(Sec. 1.1, 1.3.4, 1.5), Fig. AP1-2	
75.	UIM	User identity module	Sec. 5.1.1.4, 5.3.2, 6.3.2.11, 6.5.1, 6.5.2.3, 9.2.2.3, Appendix 1(Sec. 5.4)	Referred from ITU-R M.1224
76.	UPT	Universal personal telecommunications	Sec. 1.3, 3.4, 5.1.1.7.1, 5.3.3, 7.1.1, 7.1.2.2.4	Referred from ITU-R M.1224
77.	VLR	Visitor location register	Appendix 1(Sec. 3.2)	Referred from ITU-R M.1224

ANNEX 2

Considerations for Radio Operating Environments

(ANNEX 2, ITU-R M.1034)

The considerations leading up to the distinct 3G Mobile System radio operating environments identified in section 4.1.2 include:

– concerning 3G Mobile System mobile base stations (e.g. a base station located in a moving vehicle), these have two radio interfaces which each may be in a different radio operating environment. The total radio operating environment will have physical characteristics (propagation and relative speed) given by the radio interface communicating directly with the mobile station. However, the expected service information rates for the total operating environment will be given by the capabilities of the weakest link in the chain;

– the use of repeaters for a 3G Mobile System may have a similar impact on the total 3G Mobile System radio environment as the 3G Mobile System mobile base stations. However, for repeaters the situation is even more complicated, and repeaters cannot be identified as one or a few separate 3G Mobile System radio operating environments. However, the impact of the use of repeaters on the service capabilities of the radio interface should be taken into consideration by the 3G Mobile System operators when planning their networks;

– the urban environment is separated into pedestrian and vehicular applications, as the expected service information rates, in addition to the mobile speeds, may differ somewhat for pedestrian and vehicular urban environments. For rural environments, however, although the differences between pedestrian and vehicular applications are the same in principle, it is not considered necessary to split this environment into two separate ones;

– the rural outdoor environment is intended to cover speeds up to those for high-speed trains. Increasing the required speed for this environment to also cover aircraft could be considered. This may, however, not be justified, and may better be treated as a special case if terrestrial based aeronautical coverage is required.

Annex 3

Definitions of Speech and Audio Services

This Annex describes the detailed definitions of speech and audio services. The definition includes the performance requirements, types of connection and others. It also provides possible network models with indication of associated networks.

Special attention should be paid to the fact that the codec specification can be classified according to the degree of obligations for network operators and terminal equipment manufactures in implementing equipment to a certain specification. The service definitions provided in this Annex indicate such classes of codec specifications in accordance with the following definition of classes of standardisation;

Mandatory (M): Mandatory Specification means a single specification with which equipment shall be designed in conformity whenever such equipment is intended to be provided.

Optional (O): When a service is implemented to either of multiple specifications, but shall not use other specifications which are not defined, the set of such specifications are Optional Specifications. For Optional Specifications, a mechanism by which a particular one of Optional Specifications can be negotiated between two ends would be provided in the signalling system.

Recommended (R): Recommended Specification means the specification to which equipment is recommended to be designed as a preferred approach in order for the service to be maintained to the intended quality and connectivity. The operators and equipment manufactures may choose other specifications for the same service at their discretion.

Non-Standardised: There shall be areas where no mandatory and recommended specifications are intentionally provided.

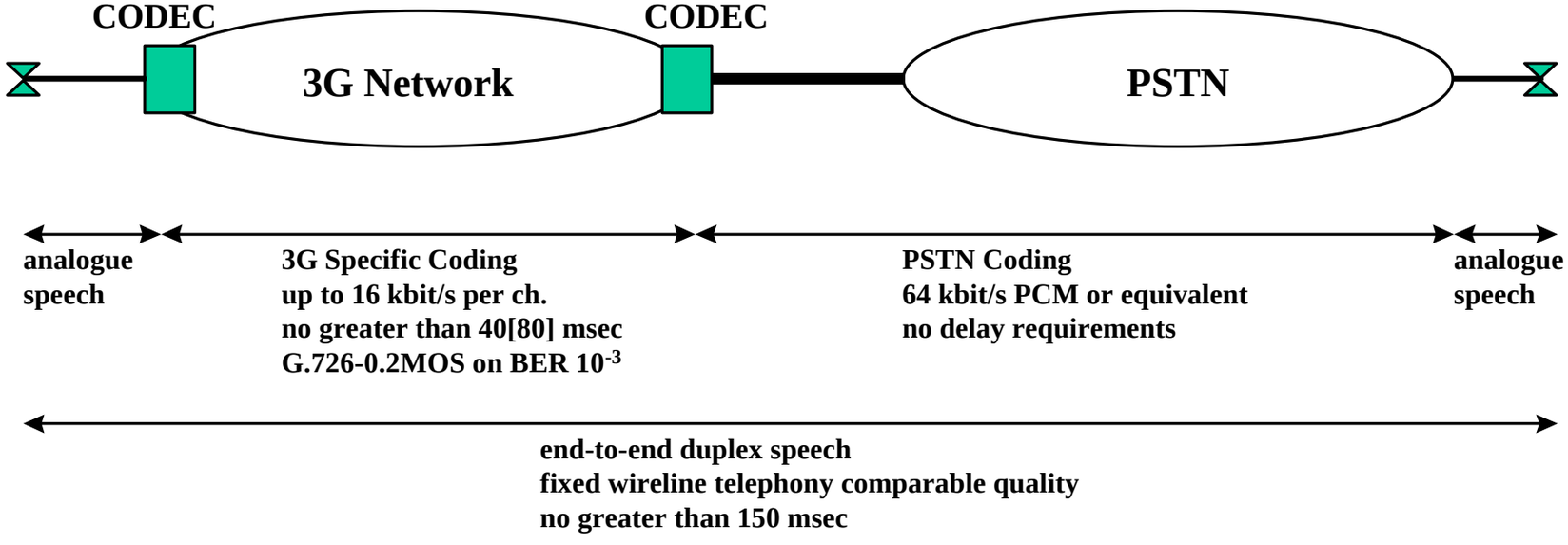
Speech/Audio application
Service Definition & Technical Requirements for the 3G System
Service: Telephony

No.	Service Name & Definition	Quality	Delay end-end	Bearer Capability			CH Char.	Connection		Protocol	CODEC	Network Configuration	Operation Environment	Remark
				Bit Rate	BER	Delay		connection	symmetry					
1	Service : Telephony [Ref. Doc.No. :] (Definition) : Speech communication to/from fixed wireline telephone service users and within 1/2/3G PLMN users . (Info. type) voice (Data Volume) up to 16kbit/s (Real / Non-Real) real time	comparable to fixed wireline telephone (G.726-0.2MOS over one radio link at 10^{-3} BER) (G.726-0.5MOS over two radio links each at 10^{-3} BER) (Fundamental QoS: No worse than G.726 with or without ambient noise)	150ms (3G-3G 160ms, 3G-1/2G 180ms)	up to 16 kbit/s	10-3	40[80] ms for PLMN **[subj. to FS]**	circuit	PTP	symmetric		Mandatory [+ Optional ; TBD]	connected to -PSTN -ISDN -3G Mobile -other PLMNs	O/P/V (ITU-R M.1034 1~8, 10~12)	

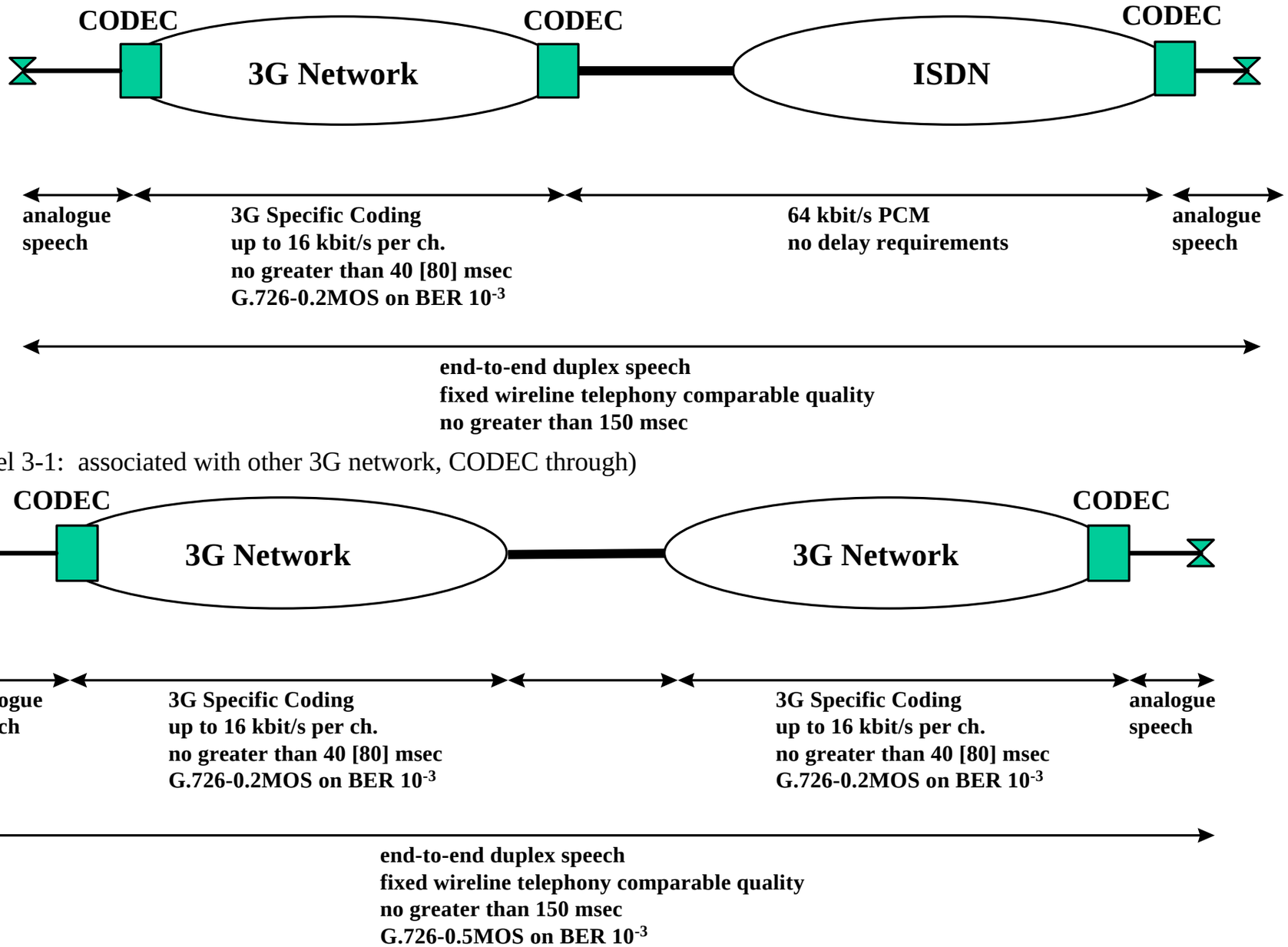
Service: Telephony

Definition: **speech communications to/from fixed wireline telephone service users and within 1/2/3G PLMN users.**
Associated Network: **PSTN, ISDN, 3G Mobile Network, other PLMNs**
Mode of Communication: **outgoing and incoming calls / duplex**
Targeted Quality: **fixed wireline speech quality with exception for connection with other PLMNs where speech quality may be limited to those of the PLMNs; no greater than 150 msec end-to-end delay with exception of 180 msec end-to end delay accepted only for 3G mobile to/from 1/2G mobile connections; up to 16 kbit/s per channel bandwidth requirement over radio interface; 10^{-3} BER over radio interface.**
Network Model:

(Model 1: associated with PSTN)

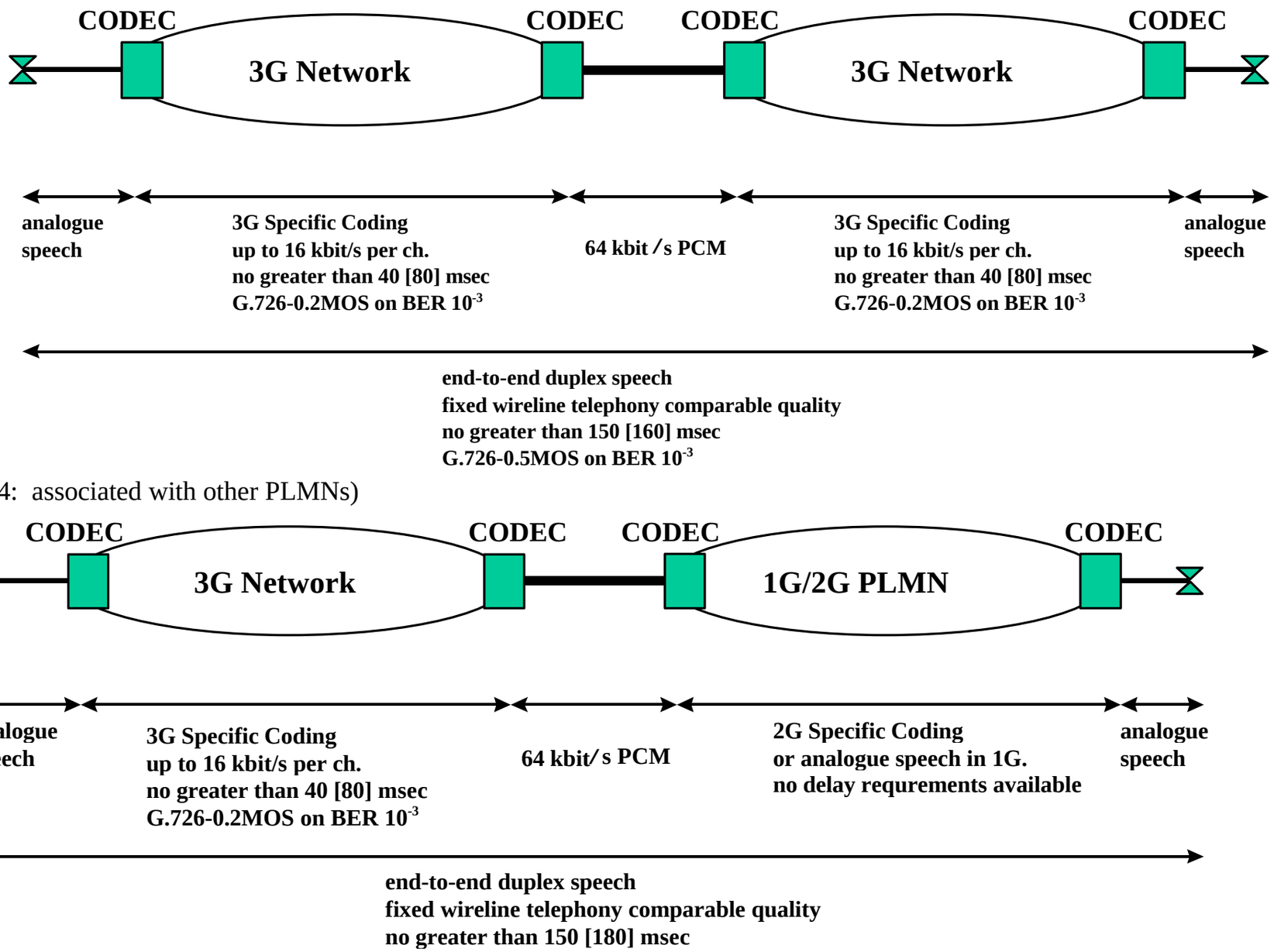


(Model 2: associated with ISDN)



(Model 3-1: associated with other 3G network, CODEC through)

(Model 3-2: associated with other 3G network)



(Model 4: associated with other PLMNs)

Speech / Audio Application
Service Definition & Technical Requirements for the 3G System
Service: High Quality Speech/Audio

No.	Service Name & Definition	Quality	Delay end-end	Bearer Capability			Connection mode	Connection		Protocol	CODEC	Network Configuration	Operation Environment	Remark
				Bit Rate	BER	Delay		connection	symmetry					
	Service : High Quality Speech [Ref. Doc.No. :] (Definition): Speech communication via bi-directional and symmetric channel within 3G users or with fixed wireline users at equivalent or better than the audio quality of G.722. (Application): High quality speech conversation, Audio conference calling. (Info. type): Speech,Music,Tone (Data Volume): up to 64kbit/s (Real / Non-Real): Real-time	Equivalent or better than G.722 (on error-free) quality. (7kHz bandwidth equivalent or better)	150ms or [180ms] for end-to-end	~16k to 64kbit/s	10^{-3} * FFS: 10^{-4} BER may be required to meet both the target quality and the delay.	40ms or [80ms] for PLMN	Circuit transfer mode	PTP	Symmetric		Optional or Recommended specification.	connected to: - 3G network - ISDN * 2G network may have a possibility.	V, P, O The environments 1, 2, 3, 4, 5, 6, 8 and 9 defined in the ITU-T M.1034 Table-2. * Satellite use may be possible if larger delay is allowed. * Mobile speed limitation requires further study.	Two types of NW connections below are assumed. -1. Codec-through (with the rate-matching if needed) is used. -2.Transcoder/IWF is placed between two NWs. Transcoding to the 4kHz-bandwidth (64kbps) PCM is not applicable. * G.722 and MPEG-4 audio codecs are expected, for example.
	Service : High Quality Audio [Ref. Doc.No. :] (Definition): On-demand based or broadcasting type information, news or music services for 3G users at equivalent or better quality than the AM or FM radio. (Application): Car entertainment, On-demand Music, Broadcasting/ Multicasting information service. (Info. type): Music, Speech (Data Volume): up to 384kbit/s (Real / Non-Real): Non-real-time	Equivalent or better than AM radio quality. (7kHz bandwidth equivalent or better)	minimize response time for user command.	~16k to 64kbit/s	10^{-6}	Not critical	Circuit transfer mode	PTP PTM	Asymmetric		Recommended specification.	connected to: - ISDN	V, P, O The environments 1, 2, 3, 4, 5, 6, 8 and 9 defined in the ITU-T M.1034 Table-2. * Mobile speed limitation requires further study.	End-to-end service * G.722 and MPEG-4 audio codecs are expected for the AM level service, for example. * MPEG-1, -2, -4 audio codecs are expected for the FM level service, for example.
		Equivalent or better than FM radio quality. (15kHz bandwidth equivalent or better)	minimize response time for user command.	~32k to 384kbit/s	10^{-6}	Not critical								

Service: High Quality Speech

Definition: **Speech communication via bi-directional and symmetric channel within 3G users or with fixed wireline users at equivalent or better than the audio quality of G.722.**

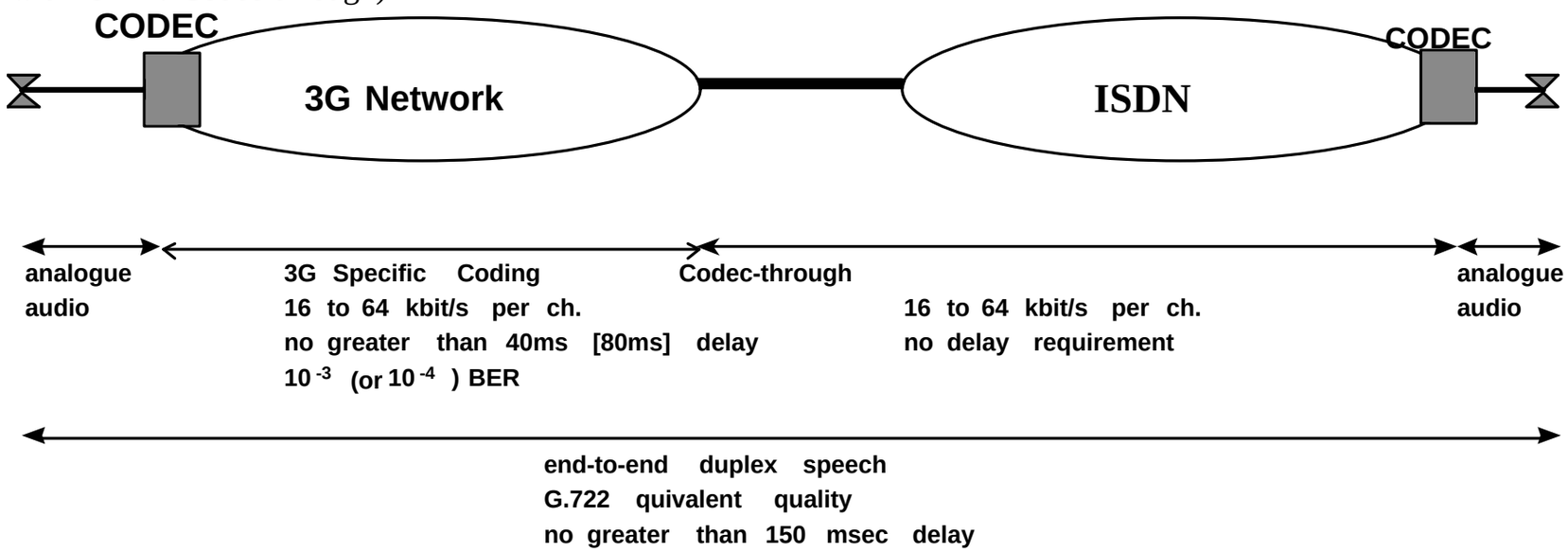
Associated Network: **3G Mobile Network, ISDN, other PLMNs.**

Mode of Communication: **outgoing and incoming/duplex, circuit transfer mode**

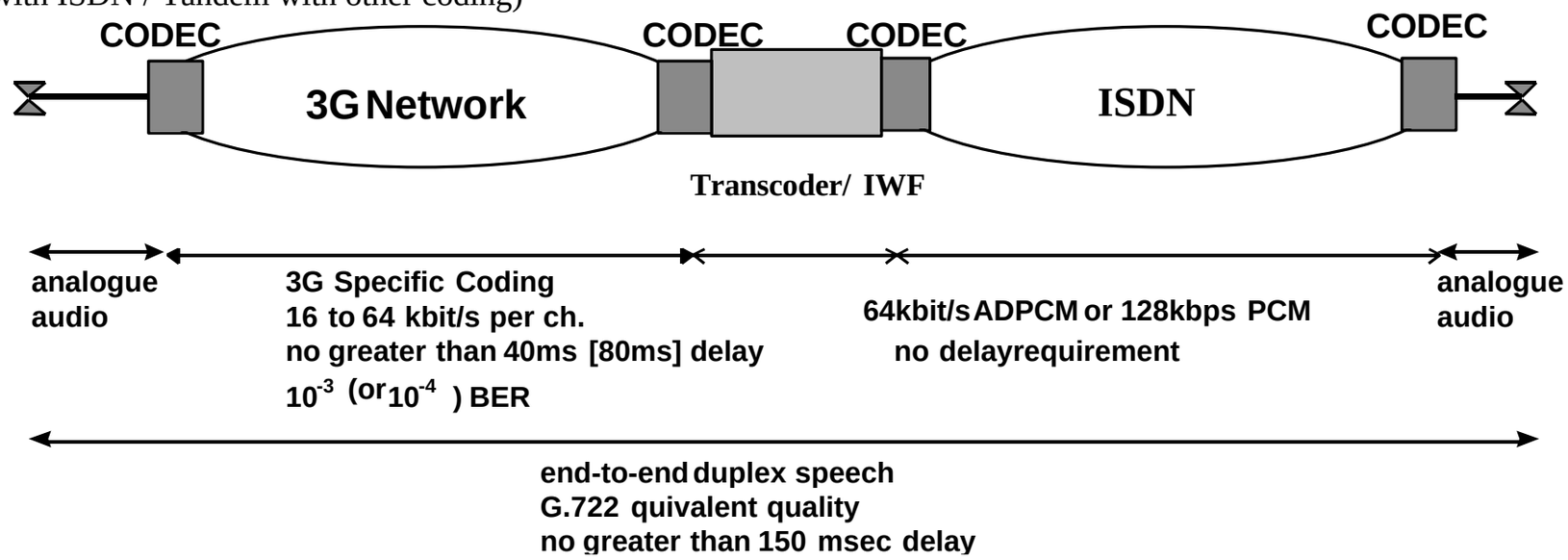
Targeted Quality: **G.722 equivalent quality (7kHz signal bandwidth equivalent quality) or better is required; No greater than 150 (180) msec end-to-end delay in any connection for real-time use; About 16 to 64 kbit/s per channel is assumed for the radio interface; 10^{-3} (10^{-4}) BER is required over radio interface.**

Network Model:

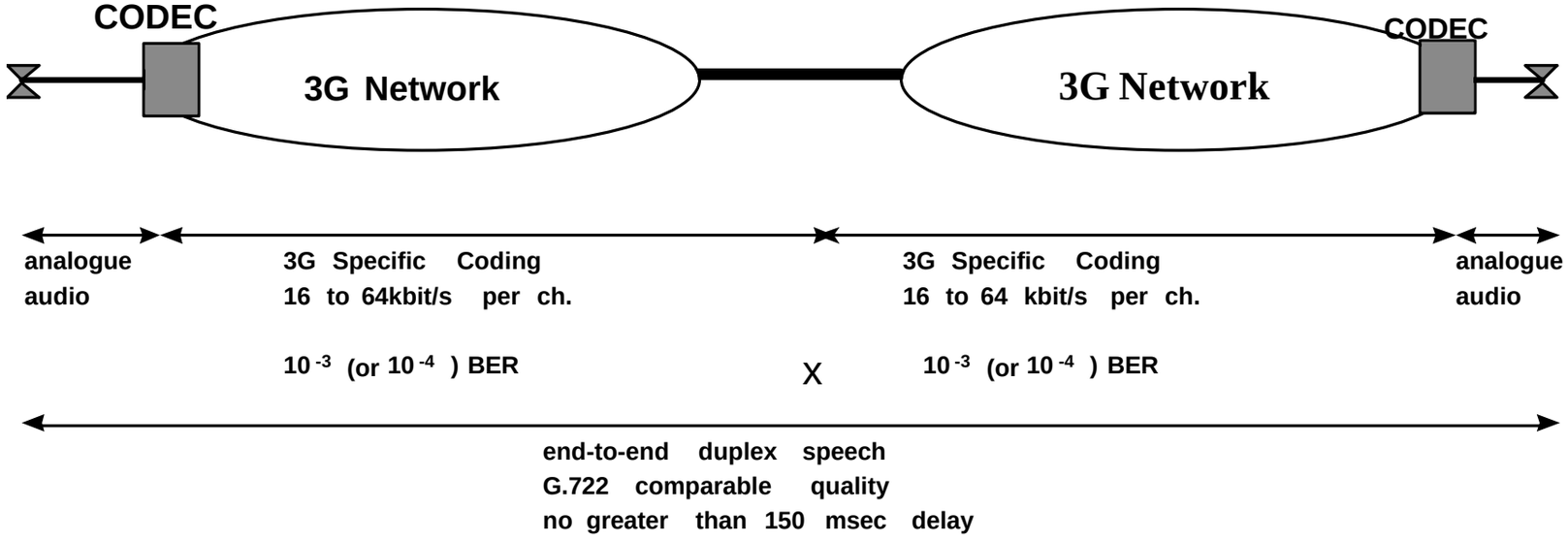
(Model 1: associated with ISDN / Codec-through)



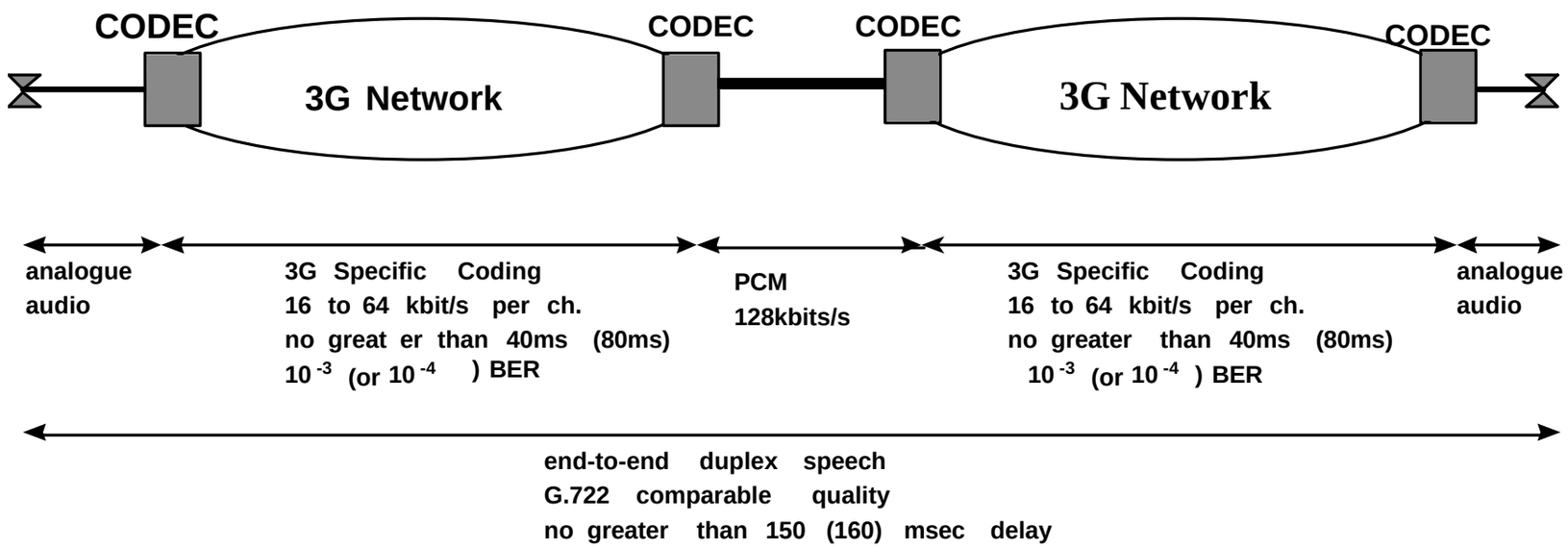
(Model 2: associated with ISDN / Tandem with other coding)



(Model 3: associated with other 3G Network / Codec-through)



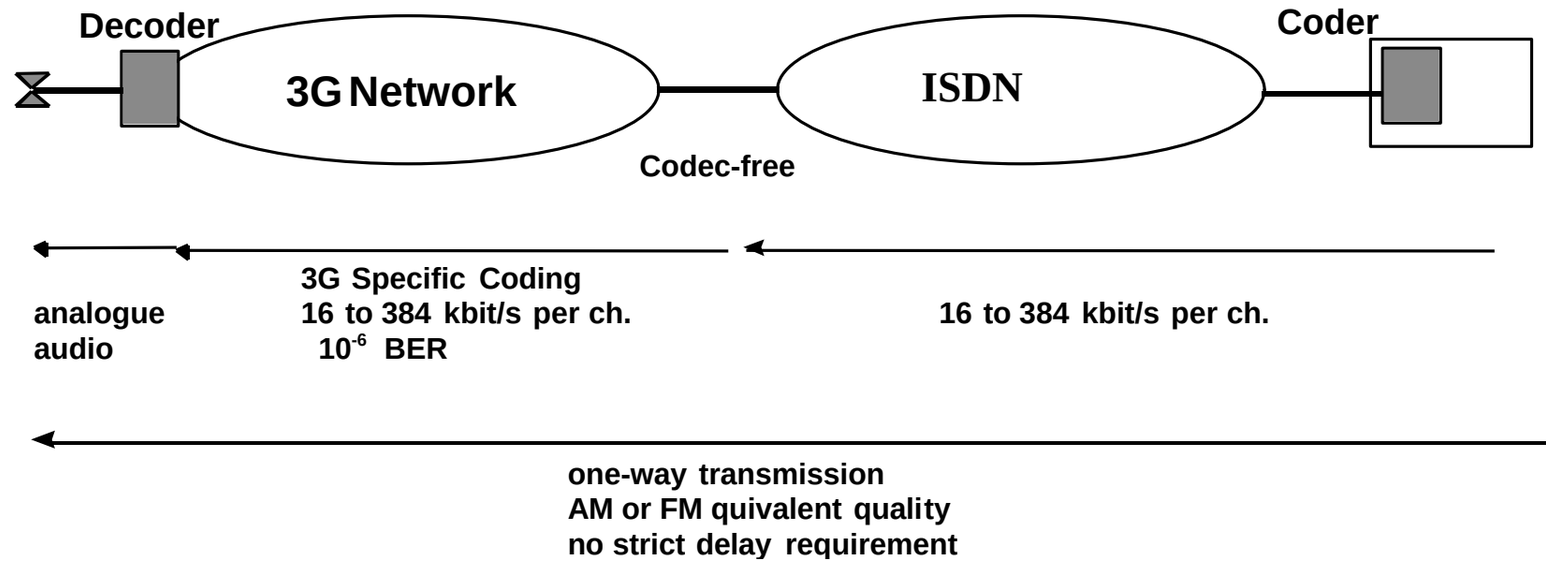
(Model 4: associated with other 3G Network / Tandem-Codec)



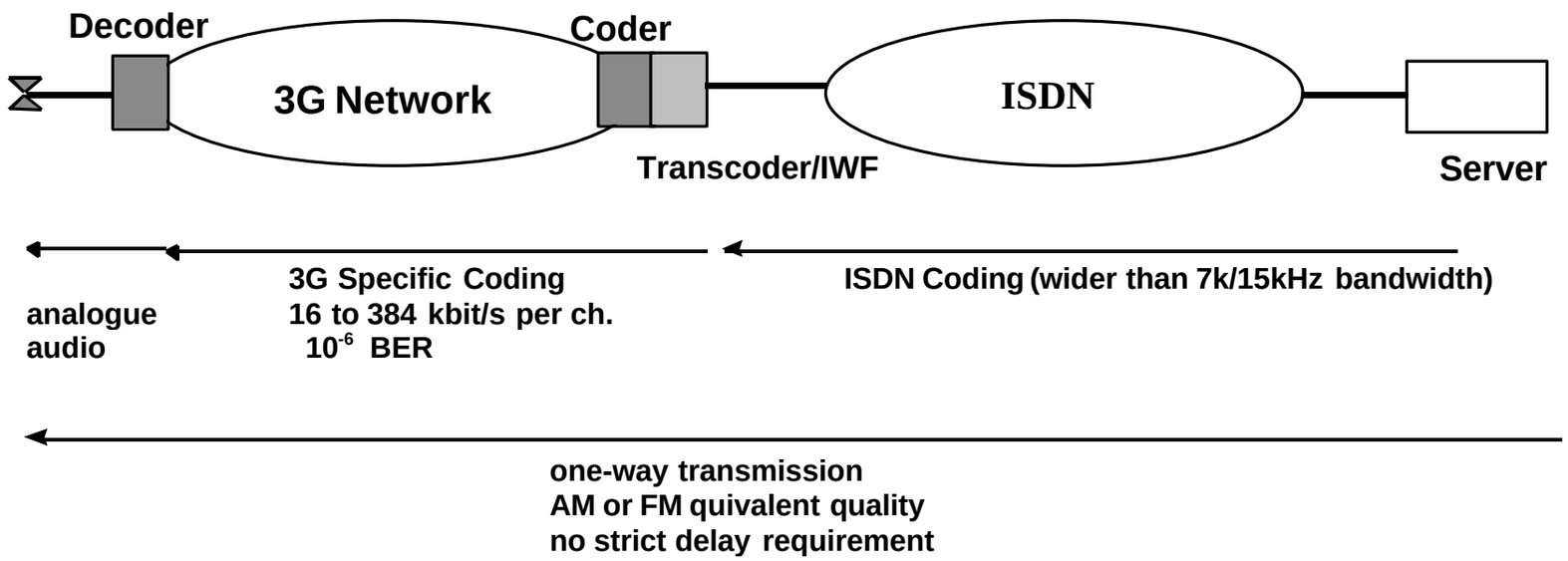
Service: High Quality Audio

Definition: **On-demand based or broadcasting type music or information services for 3G users at equivalent or better quality than the AM or FM radio.**
Associated Network: **ISDN**
Mode of Communication: **incoming/simplex, circuit transfer mode**
Targeted Quality: **AM or FM radio equivalent quality (7kHz or 15kHz signal bandwidth equivalent quality) or better is required; No strict delay requirement; Up to about 384 kbit/s per channel is assumed for the radio interface; 10^{-6} BER is required over radio interface.**
Network Model:

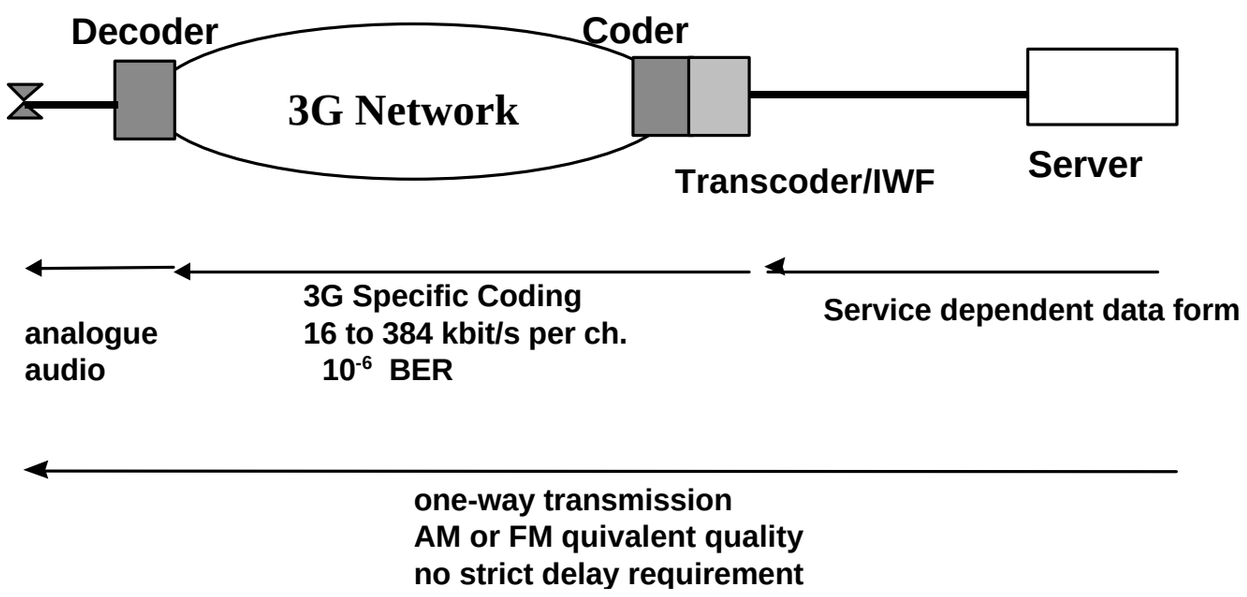
(Model 1: associated with ISDN / Codec-through)



(Model 2: associated with ISDN / with transcoding)



(Model 3: associated with Server / with transcoding)



Speech / Audio Application

Service Definition & Technical Requirements for the 3G System

Service: Hi-Fi Audio broadcasting

No.	Service Name & Definition	Quality	Delay end-end	Bearer Capability			CH. Char.	Connection		Protocol	CODEC	Network Configuration	Operation Environment	Remark
				Bit Rate	BER	Delay		connection	symmetry					
	Service: Hi-Fi Audio broadcasting **[Ref. Doc. No.:]** **(Definition):** **Music program broadcasting service with near CD or CD equivalent quality from a fixed center. As a derivative, on-demand based music source (coded data) distributing service with near CD or CD equivalent quality from a fixed center, where the uplink channel is necessary to request the service, however, the traffic bandwidth is asymmetrical.** **The program may have such contents as "this week top-ten," "few tens of second nitrous of newly released CD."** **The radio-frequency channel control is necessary, however, the traffic channel in the 3G network and ISDN is one way directional.** **The circuit transfer mode and/or connection or connectionless type packet transfer mode transmission are possible.** **(Info. type):** **Music sound and data for channel request** **(Data vol.): --** **(Real/Non-real): Real or Non-real**	**Near CD** **or** **CD equivalent**	**Not critical**	**Up to 384 kbit/s**	**10^{-6}**	**Not critical for PLMN**	**Circuit transfer mode** **Packet transfer mode**	**- PTP** **- PTM**	**Asymmetric**		**Rec.**	**ISDN**	**- O/P/V for up to 384 kbit/s** **- FS of V for more than 144 kbit/s** **Items** **(1) , (2), (3), (4), (5), (6), (8), (10), (11), (12) in ITU-R M1034, Sec.7.2**	**Transcoding may be provided in the PLMN in case of the network service.** **Protocol: TBD** **CODEC:** **TBD for 3G NW service and left for application for 3G bearer service**

Service: Hi-Fi Audio (Broadcasting)

Definition:

Music program broadcasting service with near CD or CD equivalent quality from a fixed center. As a derivative, on-demand based music source (coded data) distributing service with near CD or CD equivalent quality from a fixed center, where the uplink channel is necessary to request the service, however, the traffic bandwidth is asymmetrical.

The radio-frequency channel control is necessary, however, the traffic channel in the 3G network and ISDN is one way directional.

The circuit transfer mode and/or connection or connectionless type packet transfer mode transmission are possible.

Associated Network: **ISDN**

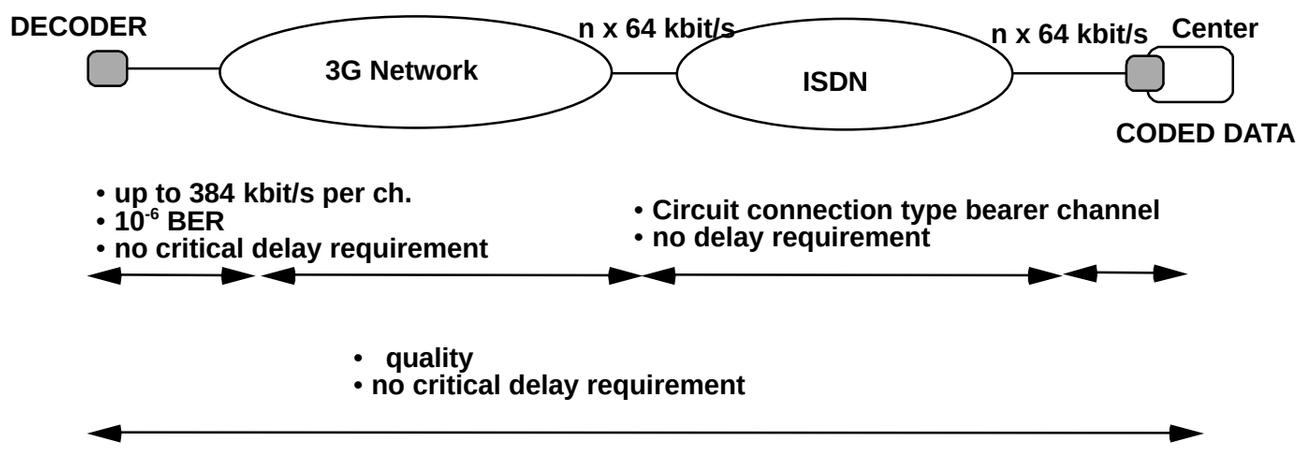
Mode of Communication: **incoming calls / broadcasting**

Targeted Quality:

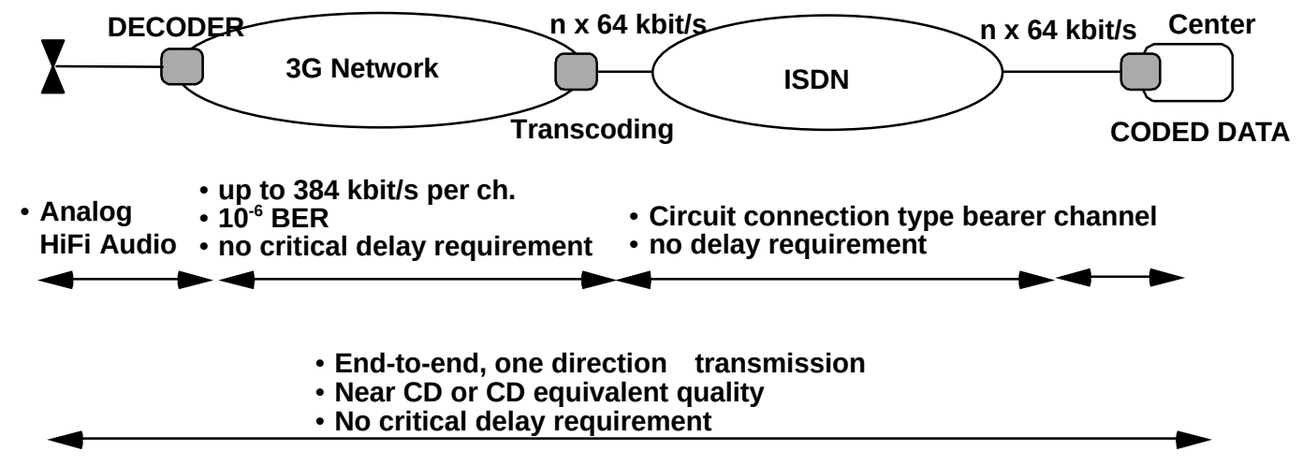
near CD or CD equivalent quality for music service; greater than 150 msec end-to-end delay in any connection is acceptable; up to 384 kbit/s per channel bandwidth requirement over radio interface; 10^{-6} BER over radio interface.

Network Model:

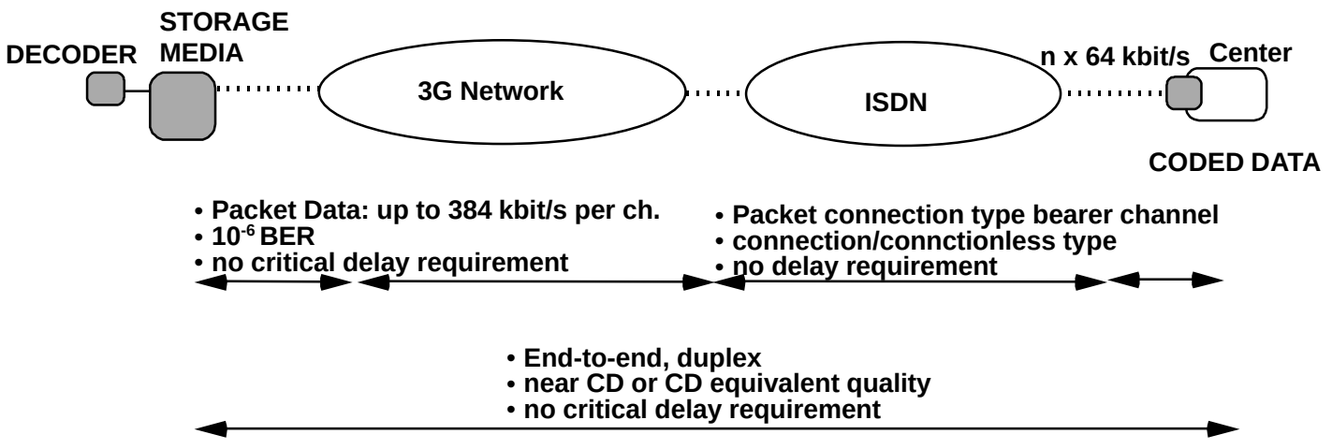
(Model 1: associated with ISDN: Circuit transfer mode)



(Model 2: associated with ISDN: Circuit transfer mode with transcoding)



(Model 3: associated with ISDN: Packet transfer mode)



Annex 4

Definitions of Video and Data Services

These attached tables describe definitions and requirements of each video and data services defined in chapter 5. Required bearer capability of both circuit transfer mode and packet for each services are shown in the table.
In addition, to present model case of network connection about each service, attached figures show typical these configuration.

QoS Table

Video - Real Time, Bi-directional

No.	Service Category	[Delay] (end-to-end)	*User Data rate*	***Bearer Capability***					Connected Network		Connection		Remark
				Packet transfer mode			***Circuit transfer mode***						
				BER	***Priority***	***Packet size(length)***	***BER***	***Delay (PLMN)***	*Circuit mode*	*Packet mode*	connection type	symmetric / asymmetric	
1.	*Service :Video Telephone/Conference [Ref. Doc.No. :] (Definition) : - real-time bidirectional communication using video and voice (Info. type):Video (with voice) (Data Volume): (Real / Non-Real):Real time*	*150msec. ~ 400msec*	*min. 16kbit/s*	*10^{-3} 10^{-6} $[10^{-4}]$ ref. Remark*	***-Priority requested (CBR*)***		*10^{-3} 10^{-6} $[10^{-4}]$ ref. Remark*	*should be minimized (Lower delay CH applicable)*	*(connected network) - ISDN - Internet (PSTN)*	*(connected network) - ISDN - Internet (PSTN) (CH rate) - Constant*	*PTP PTM MTM Type: CO*	*symmetric*	*To minimize the delay value, "10^{-4}" should be considered in addition to "10^{-6}"*
2.	*Service : High Quality Video Telephone/Conference [Ref. Doc.No. :] (Definition) : - real-time bidirectional communication using voice and high-quality video (Info. type):Video (with voice) (Data Volume): (Real / Non-Real):Real time*	*150msec ~ (less than 400msec)*	*min. 64kbit/s*	*10^{-3} 10^{-6} $[10^{-4}]$ ref. Remark*	***-Priority requested (CBR*)***		*10^{-3} 10^{-6} $[10^{-4}]$ ref. Remark*	*should be minimized (Lower delay CH applicable*	*(connected network) - ISDN - Internet (PSTN)*	*(connected network) - ISDN - Internet (PSTN) (CH rate) - Constant*	*PTP PTM MTM Type: CO*	*symmetric*	*To minimize the delay value, "10^{-4}" should be considered in addition to "10^{-6}"*

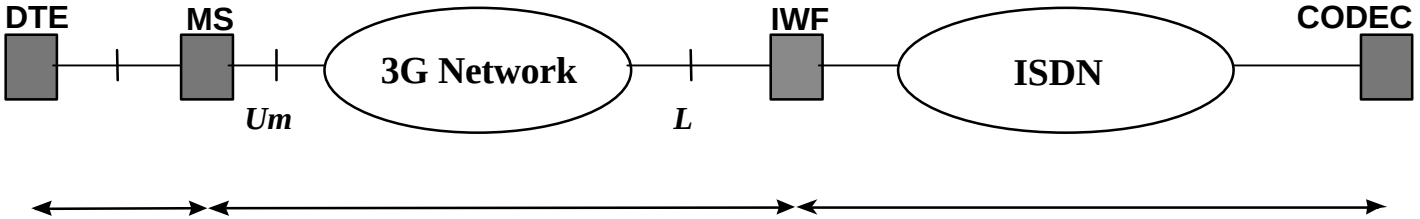
(*) CBR : Constant Bit Rate

NOTE :
Some application may have a capability to keep required lower BER (e.g. 10^{-6}) by adopting additional error collection code. Such additional code and user data are multiplexed by those application side, not TRX.
In this case, the air channel which has BER=10^{-3} quality can be used for those application.
If the application does not have the above feature, the system should provide a BER=10^{-6} quality channel.

Network Model

Service : Video Telephone/Conference

(Model -1 : associated with ISDN)



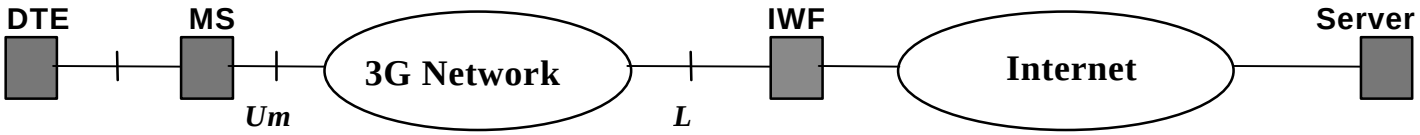
Digital data
video /voice /
text

(Circuit / Packet Bearer)
Mainly 32kbit/s, 64kbit/s and 128kbit/s per ch.
10^{-6} BER

$mH_0 + nB$
no delay requirement

end-to-end duplex
video : equivalent to MPEG4, H.263+ .(picture size: equiv. to QCIF.)
speech : equivalent to 3GMS telephone quality
150msec ~ 400msec

(Model -2 : associated with internet)



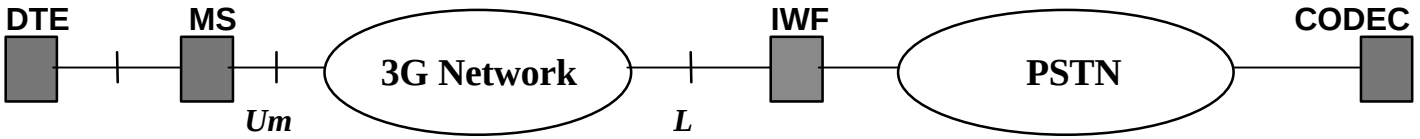
Digital data
video /voice /
text

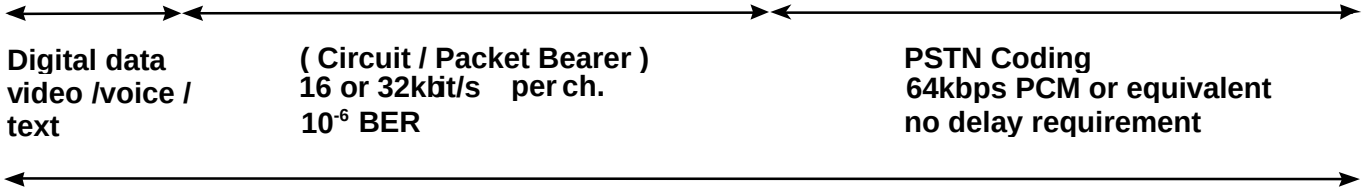
(Circuit / Packet Bearer)
Mainly 32kbit/s, 64kbit/s and 128kbit/s per ch.
10^{-6} BER

no delay requirement

end-to-end duplex
video : equivalent to MPEG4, H.263+. (picture size: equiv. to QCIF.)
speech : equivalent to 3GMS telephone quality
150msec ~ 400msec

(Model -3 : associated with PSTN)

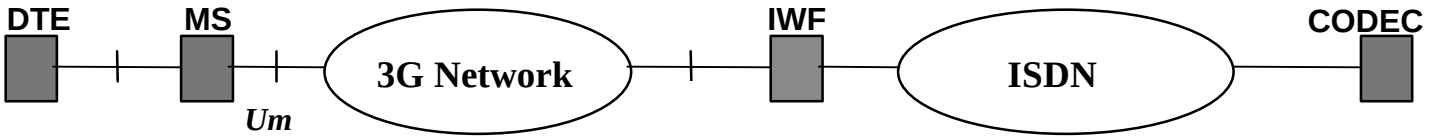




end-to-end duplex
video :equivalent to MPEG4, H.263+.(picture size: equiv. to QCIF.)
speech :equivalent to 3GMS telephone quality
150msec ~ 400msec

Service : High Quality Video Telephone/Conference

(Model -1 : associated with ISDN)



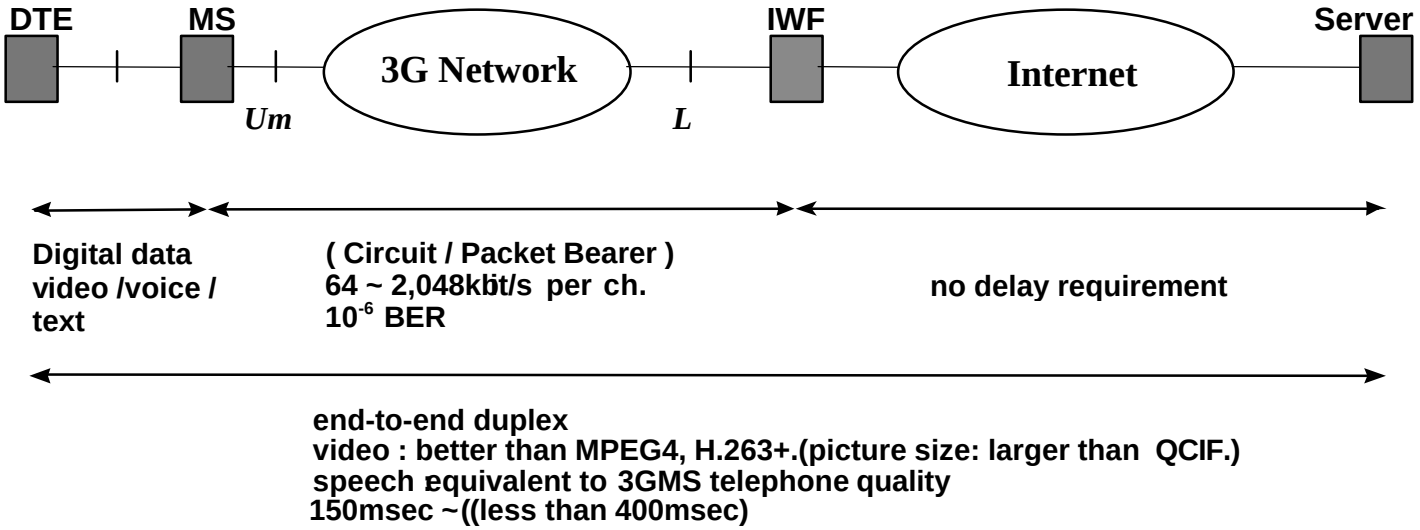
Digital data
video /voice /
text

(Circuit / Packet Bearer)
64 ~ 2,048kbit/s per ch.
10^{-6} BER

$mH_0 + nB$
no delay requirement

end-to-end duplex
video : better than MPEG4, H.263+.(picture size: larger than QCIF.)
speech : equivalent to 3GMS telephone quality
150msec ~ (less than 400msec)

(Model -2 : associated with internet)



QoS Table

Streamline Video (On-line reproduction without Storage)

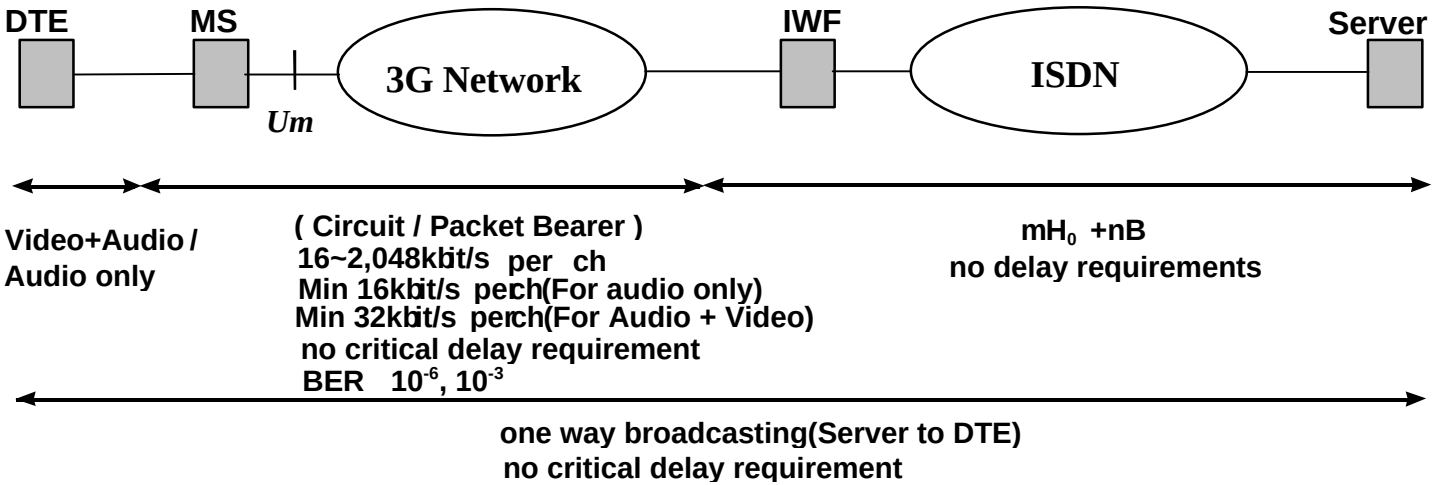
No.	Service Category	[Delay] (end-to-end)	*User Data rate*	*Bearer Capability*					Connected Network		Connection		Remark
				Packet transfer mode			*Circuit transfer mode*						
				BER	*Priority*	*Packet size(length)*	*BER*	*Delay (PLMN)*	*Circuit mode*	*Packet mode*	connection type	symmetric / asymmetric	
1	*Service : Video + audio broadcasting (Definition) : -Broadcast audio/video distribution -On-line reproduction of data from the network -Video multicast (news, misc. information, etc.) (Info. type): Video with audio, audio only (Data Volume): Downlink:16~2Mbit/s (Real / Non-Real): Non real-time*	*no requirement*	*Min. for audio only: 16kbit/s for video and audio: 32kbit/s*	*10^{-3} 10^{-6}*	*Priority requested or unspecified*		*10^{-3} 10^{-6}*	*no requirement*	*ISDN Internet (3G Network and PSTN are also possible)*	*ISDN Internet (3G Network and PSTN are also possible)*	*PTP and multicast Type: Mostly CL*	*Asymmetric (Downlink only) .*	*For the termination And conversion, IWF is required.*
2	*Service: video + audio on*	*Amount*	*Uplink*	*10^{-3}*	*unspecified*		*10^{-3}*	*no*	*ISDN*	*ISDN*	*PTP*	*Asymmetric*	

	demand. *(Definition) :* *-Video (or still mage)+audio mail* *-Audio/Video(with audio) download on demand (weather, news, misc., information, commercial ADs, sports, etc.)* *(Info. type): Video with audio or audio only* *(Data volume):* *Uplink:1kbyte/command* *Downlink:16~2Mbit/s* *(Real-time/non real-time):* *Non real-time*	*tolerable by TCP/IP retransmission*	*16Kbit/s* *Downlink Min. for audio only: 16kbit/s for video: and audio 32kbit/s*	*10^{-6}*			*10^{-6}*	*requirement*	*Internet (3G Network and PSTN are also possible)*	*Internet (3G Network and PSTN are also possible)*	*Type : CL or Co*		

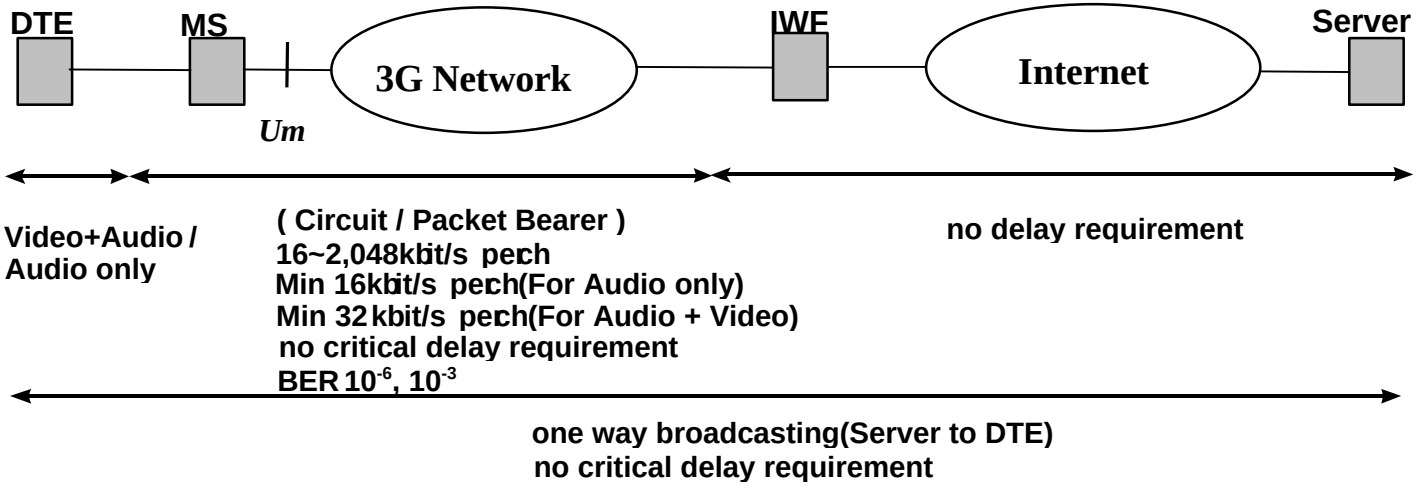
NOTE :
Some application may have a capability to keep required lower BER (e.g. 10^{-6}) by adopting additional error collection code. Such additional code and user data are multiplexed by those application side, not TRX.
In this case, the air channel which has BER=10^{-3} quality can be used for those application.
If the application does not have the above feature, the system should provide a BER=10^{-6} quality channel.

Service : Video+Audio Broadcasting

(Model -1 : associated with ISDN)



(Model –2 : associated with INTERNET)

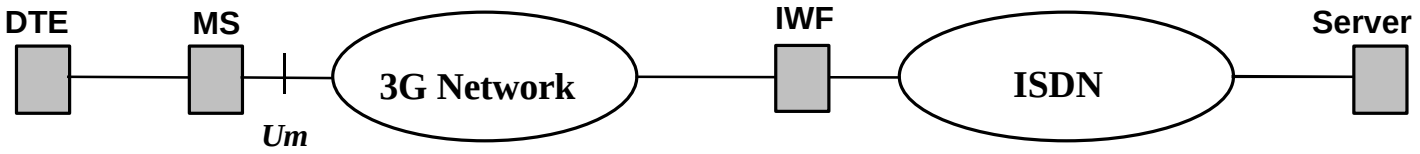


(Other Model : Systems associated with PSTN and other 3G Network are also possible, but those cases may be rare.)

Network Model

Service : Video+Audio on Demand

(Model -1 : associated with ISDN)



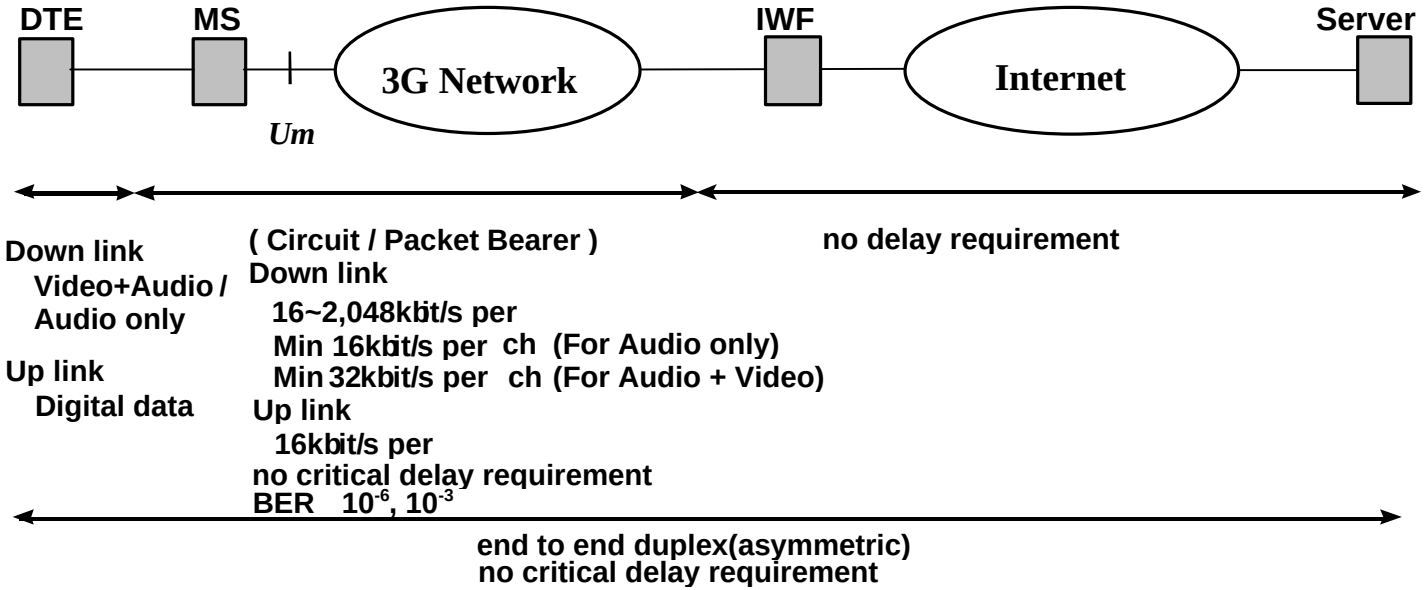
Down link
Video+Audio / Audio only
Up link
Digital data

(Circuit / Packet Bearer)
Down link
16~2,048kbit/s per ch
Min 16kbit/s per ch (For Audio only)
Min 32kbit/s per ch (For Audio + Video)
Up link
16kbps perch
no critical delay requirement
BER 10^{-6}, 10^{-3}

mH_0 +nB
no delay requirement

end to end duplex(asymmetric)
no critical delay requirement

(Model –2 : associated with INTERNET)



(Other Model : Systems associated with PSTN and other 3G Network are also possible, but those cases may be rare.)

QoS Table

Data Application

No.	Service Category	[Delay] (end-to-end)	*User Data rate*	*Bearer Capability*					Connected Network		Connection		Remark
				Packet transfer mode			*Circuit transfer mode*						
				BER	*Priority*	*Packet size(length)*	*BER*	*Delay (PLMN)*	*Circuit mode*	*Packet mode*	connection type	symmetric / asymmetric	
1.	Service : ***Internet Access*** (Definition) : *Data transmission services to/from Internet provider connected to fixed wireline service, such as* - *WWW* - *E-mail* - *FTP* - *Telnet* - *Chat* (Info.type) *Data* (Data Volume) *a few byte - a few M byte* (Real / Non-Real) *Non-real time*	*minimize response time for user command*	*Packet transfer mode : up to 2Mbit/s* *Circuit transfer mode: 8Kbit/s 16Kbit/s 32Kbit/s 64kbit/s, 128kbit/s 256kbit/s 384kbit/s 2Mbit/s* *Voice band data modem* *(It depends on the contents.)*	*10^{-6}* *10^{-3}* *(note1)*	*-unspecified (Best Effort type)*		*10^{-6}* *10^{-3}* *(note1)*	*(TBD)*	*- Internet*	*- Internet*	*PTP, PTM* *Type: CL CO*	*Asymmetric* *Symmetric.*	
2	Service : ***On Demand Download Services*** (Definition) : *For these services, the network needs to provide higher capacity in the downlink than in the uplink.* *- News On Demand* *- Information Search* *- Electric Commerce* *- Electric Publishing* *- Information on Demand*	*minimize response time for user*	*Packet transfer mode :* *up to 2Mbit/s* *Circuit transfer mode:*	*10^{-6}* *10^{-3}* *(note1)*	*-unspecified (Best Effort type)*		*10^{-6}* *10^{-3}* *(note1)*	*(TBD)*	*- Internet* *- ISDN* *- Other 3G networks (PSTN)*	*- Internet* *- ISDN* *- Other 3G networks (PSTN)*	*PTP, PTM* *Type: CL*	*Asymmetric* *<u>Example</u>* *Downlink : -* *Large* *Uplink :*	

	- Digital Library *- Mobile Concierge* *- On Line Banking* *- Karaoke* *- Database Access* (Info. Type) *Data (Text, Image, Voice)* (Data Volume) *a few Kbytes - a few 10M bytes* (Real / Non-Real) *Non-Real-Time*		*8Kbit/s* *16Kbit/s* *32Kbit/s* *64kbit/s,* *128kbit/s* *256kbit/s* *384kbit/s* *2Mbit/s* *Voice band data modem* *(It depends on the contents, and up/downlinks.)* *(note2)*									
3	*Service : Broadcasting Services* *(News On Demand)* *(Definition) :News server always multicasts update header with brief summary to users by connectionless mode. Users can select any topics , then download the detailed information from server.* *- News On Demand* (Info. type):*Data (image / Text / Voice)* (Data Volume):*a few k bytes ~ a few M bytes* (Real /Non-Real):*Non Real Time*	*minimize response time for user command*	*Packet transfer mode :* *up to 2Mbit/s* *(It depends on the contents, up/downlinks, and multicast/unicast.)* *(note2)*	*10^{-6}* *10^{-3}* *(note1)*	*-unspecified (Best Effort type)*		*10^{-6}* *10^{-3}* *(note1)*	*(TBD)*		*- Internet* *- ISDN* *- Other 3G networks (PSTN)*	*PTP, PTM* *Type: CL*	*Asymmetric* *<u>Example</u>* *Downlink :* *- Large* *Uplink :* *- Small*	
4	Service : ***Other Data Services*** (Definition) : *The network provide the services in constant speed without*	*minimize response time for user command*	*Circuit transfer mode:* *16Kbit/s*	*10^{-6}* *10^{-3}* *(note1)*	*-Priority requested (CBR*)*		*10^{-6}* *10^{-3}* *(note1)*	*(TBD)*	*- Internet* *- ISDN* *- Other 3G networks (PSTN)*	*- Internet* *- ISDN* *- Other 3G networks (PSTN)*	*PTP, PMP* *Type: CO*	*Asymmetric* *Symmetric*	

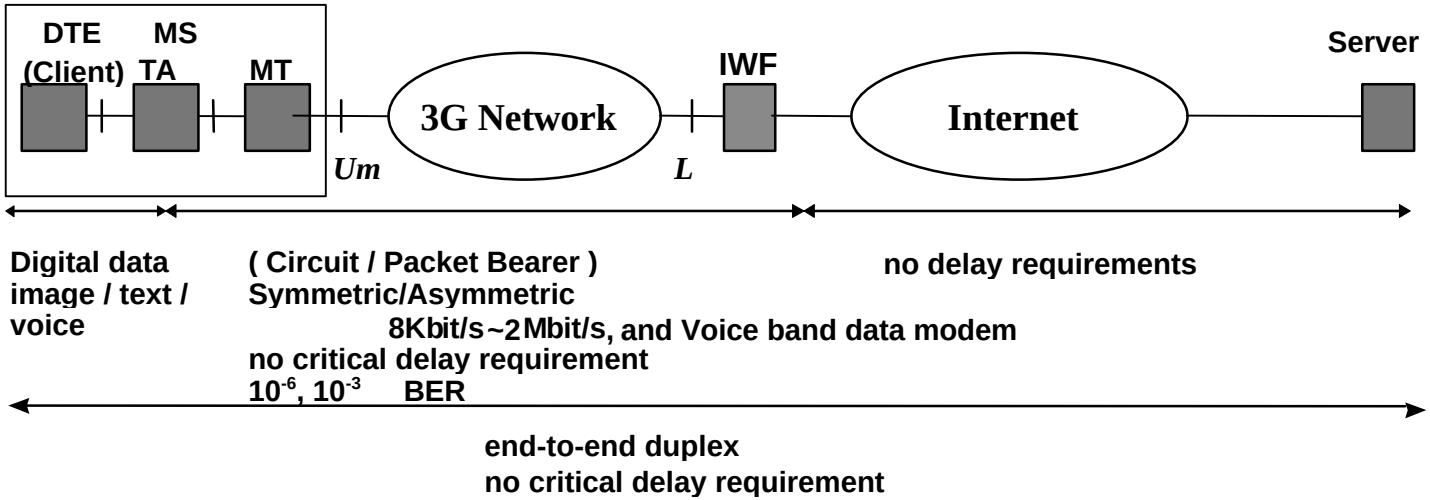
	some transrecorder. *- Telemedicine* *- Remote/Mobile Office* *- Virtual Game* *- Public Data Transmission Service* *- Home Security* (Info. type) *Data* (Data Volume) *16Kbit/s-2Mbit/s* (Real / Non-Real) *Real Time, Non-Real Time*:		*32Kbit/s* *64Kbit/s* *128Kbit/s* *384Kbit/s* *2Mbit/s* *Packet transfer mode : up to 2Mbit/s* *(It depends on the contents*										

(note1) Example : *(1) small or only text data : 10^{-3}, (2) large image data : 10^{-6}*
(note2) Example : *(1) unlink: 8Kbit/s-64Kbit/s, (2) downlink: 32Kbit/s-2Mbit/s*
(note3) Example : *(1) uplink: 8Kbit/s-64Kbit/s, (2) downlink: 32Kbit/s-2Mbit/s, (3) multicast: 8Kbit/s-64Kbit/s*

CBR.Constant Bit Rate

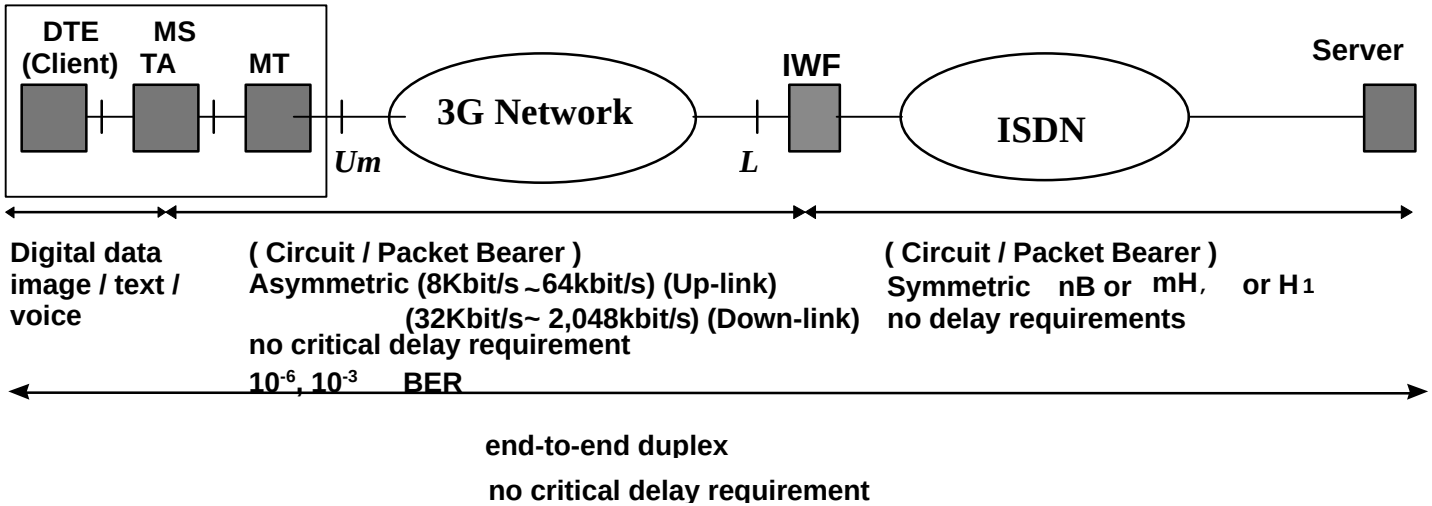
NOTE :
Some application may have a capability to keep required lower BER (e.g. 10^{-6}) by adopting additional error collection code. Such additional code and user data are multiplexed by those application side, not TRX.
In this case, the air channel which has BER=10^{-3} quality can be used for those application.
If the application does not have the above feature, the system should provide a BER=10^{-6} quality channel.

Service : Internet Access



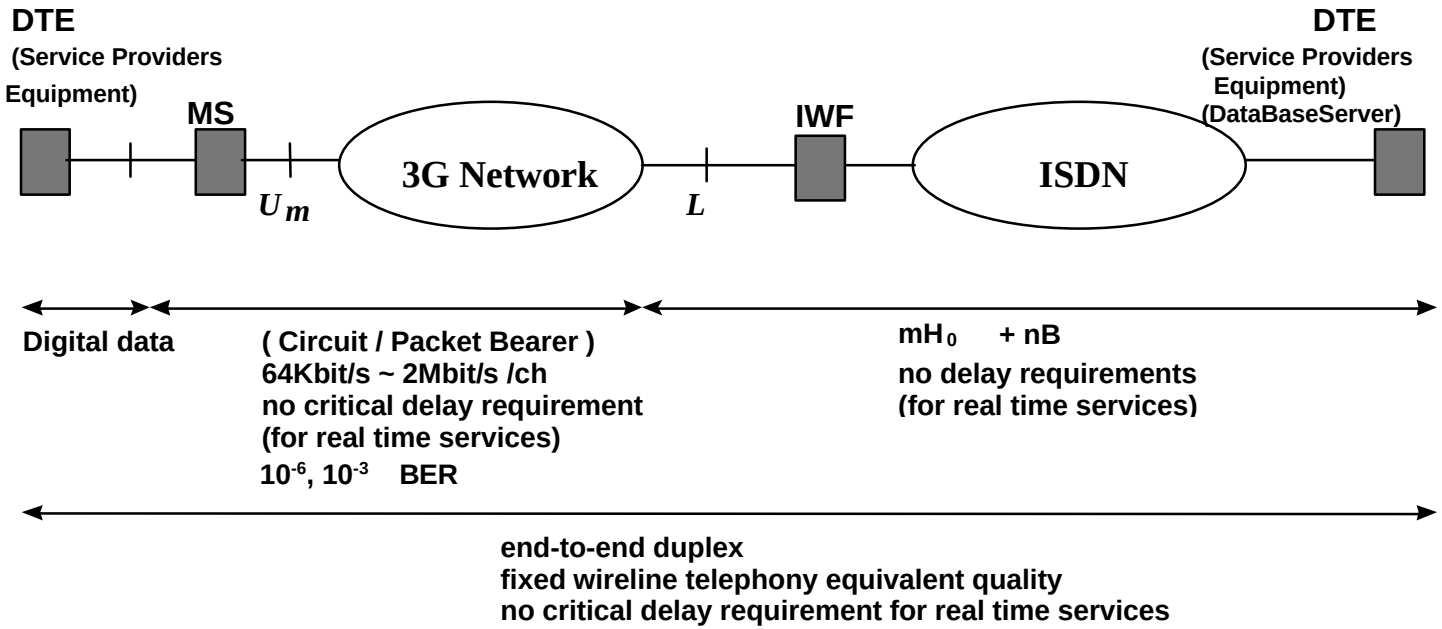
- The server in the above figure may be located in the 3G network.

Service : On Demand Download Services, Broadcasting services (News On Demand)



- Instead of the ISDN in the above figure, PSTN or other 3G network may be connected to the 3G network.
- The server in the above figure may be located in the 3G network.

Service : Other Data Services



- Instead of the ISDN in the above figure, PSTN or other 3G network may be connected to the 3G network.

QoS Table

Mobile Specific Service

<< Definition - 1 : Navigation service >>

No.	Service Category	[Delay] (end-to-end)	*User Data rate*	***Bearer Capability***					Connected Network		Connection		Remark
				Packet transfer mode			***Circuit transfer mode***						
				BER	***Priority***	***Packet size(length)***	***BER***	***Delay (PLMN)***	*Circuit mode*	*Packet mode*	connection type	symmetric / asymmetric	
1.	*(Definition - 1 : Navigation service) :* *- User connect swith a car navigation service provider from vehicular (or pedestrian), and downloads update information, e.g. map data, supplimental information around that area. The service may be activated by oral command.* *(Info. type):* *Voice,Audio,Video(with voice and data),Image, Text and Data* *(Data Volume):* *64kbit/s ~ 128/144kbit/s ~ 384kbit/s* *(Real / Non-Real):* *Non-Real Time (download)* *Quasi-Real Time (Bi-directional)*	*minimize response time for user command*	*Packet transfer mode : min. up to 384 kbit/s* *Circuit transfer mode: min. 64kbit/s, 128kbit/s 256kbit/s 384kbit/s*	***10^{-3} 10^{-6}***	***-Priority specified (Option*1)*** ***or*** ***-unspecified (Best Effort type)***		***10^{-3} 10^{-6}***	***- minimize response time for user command***	*- ISDN - Internet (PSTN)*	*- ISDN - Internet (PSTN)*	*PTP* *Type: CO*	*Asymmetric* *Downlink : - Large* *Uplink - Small* *Uplink should be needed to send user commands and authentification data for charging.*	**1: If Navigation services is applied to support an interactive service, response time may be additionally specified to meet the application.*

(*) CBR : Constant Bit Rate

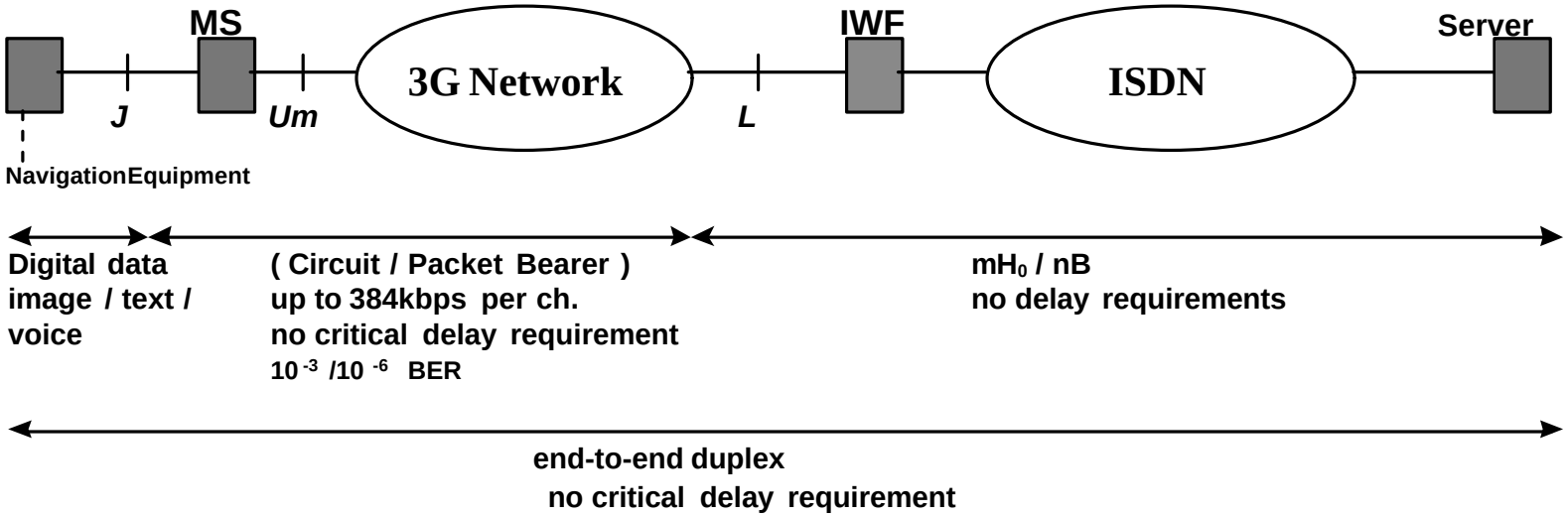
NOTE :
Some application may have a capability to keep required lower BER (e.g. 10^{-6}) by adopting additional error collection code. Such additional code and user data are multiplexed by those application side, not TRX.
In this case, the air channel which has BER=10^{-3} quality can be used for those application.
If the application does not have the above feature, the system should provide a BER=10^{-6} quality channel.

Network Model

Service : *Mobile Specific Service (1-1)*

< Definition-1 : Navigation Service >

(Model -1 : associated with ISDN)

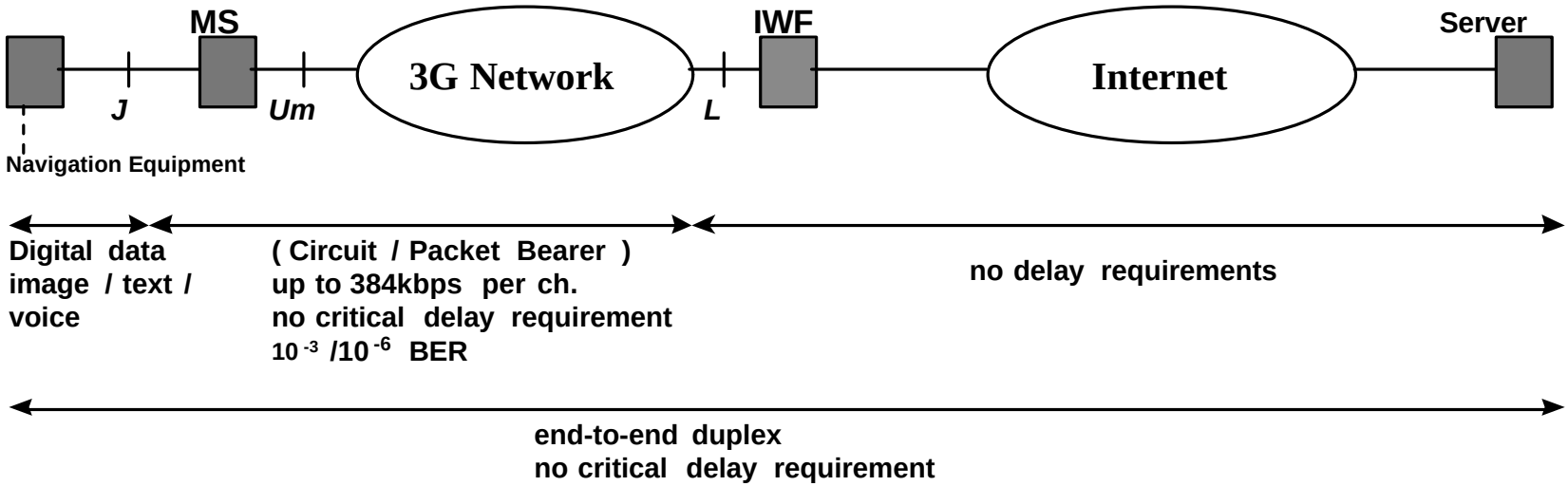


Network Model

Service : *Mobile Specific Service (1-2)*

< Definition-1 : Navigation Service >

(Model -2 : associated with Internet)



QoS Table

Mobile Specific Service

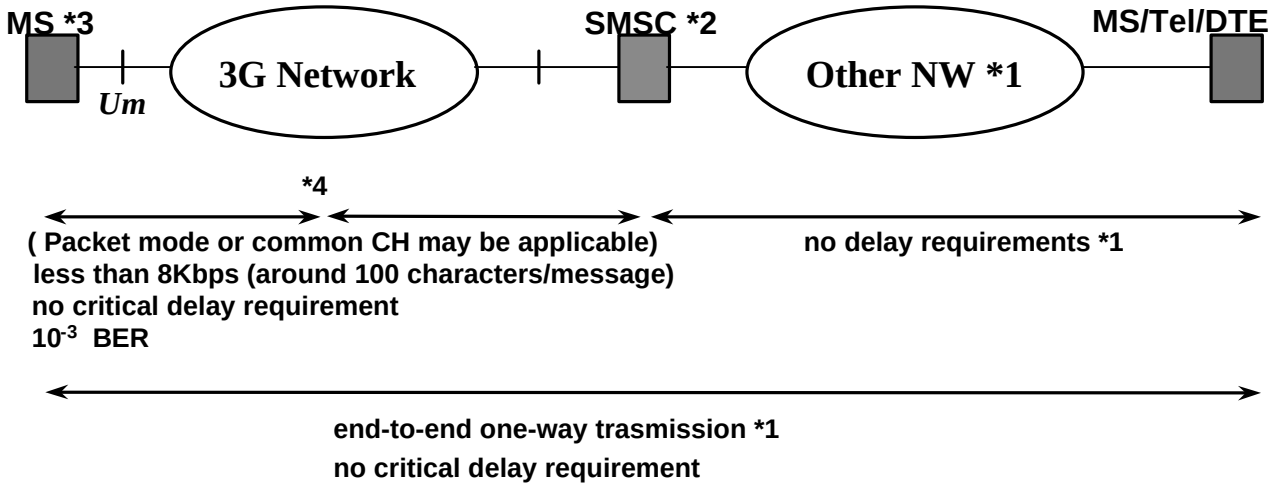
<< Definition - 2 : Short message service >>

No.	Service Category	[Delay] (end-to-end)	*User Data rate*	***Bearer Capability***					Connected Network		Connection		Remark
				Packet transfer mode			***Circuit transfer mode***						
				BER	***Priority***	***Packet size(length)***	***BER***	***Delay (PLMN)***	*Circuit Mode*	*Packet Mode*	Connection Type	symmetric / asymmetric	
1.	***(Definition - 2 : Short message service (SMS)) :*** *- Text level message transmission to/from other network users and 3G users.* *(Info. type):* *Text and Data* *(Data Volume):* *approx. 100-200 characters /message* *(Real / Non-Real):* *Non-real time, store and forward, and one-way transmission service.*	*Equivalent to the existing SMS*	*less than 8kbit/s* *common control channel or packet service may be suited for this application*	***10^{-3}***	***-Priority specified (Option*1)*** ***or*** ***-unspecified (Best Effort type)***	***100~200 bytes*** ***One or two packet may be enough to carry whole message.***	*10^{-3}*	**1*	*(connected network)* *-ISDN* *-Internet* *-PSTN*	*(connected network)* *-ISDN* *-Internet* *-PSTN* *(CH rate)* *-Priority (for PTP)* *or* *-Best Effort (for PTM)*	*PTP (User-SMSC, User-User) Type: CL* *PTM *2 (SMSC to MS) Type: CL*	*Asymmetric* *Downlink :* *- Very small* *Uplink* *- Very small* *one of two links is used to send message*	**1:* *If SMS is applied to support an interactive service, response time may be additionally specified to meet the application.* *An example of this type application is "Smart Phone" application for a 2G network.* **2:* *"Cell broadcast" service is specified in a 2G network as an application of SMS PTM type service.*

Network Model

Service : *Short message service (SMS)*

(Model : associated with PSTN/ISDN/2G/3G/Internet *1)



***1: Since short message service is a store-and-forward type message delivery service, various SMSC access methods may be considered depending on the capability of the intermediate network to submit short messages.**

***2: SMSC: Short Message Service Center**

***3: Usually message service terminates at MS in 3G Network. Some SMS application allow direct communication between MS's.**

***4: Short message may be sent over a control channel such as user access signaling channel and Common Channel Signaling channel. Packet transfer mode would be recommend in the case that short message traffic causes overload on signaling channel.**

QoS Table

Mobile Specific Service

<< Definition - 3 :Paging service >>

No.	Service Category	[Delay] (end-to-end)	*User Data rate*	***Bearer Capability***					Connected Network		Connection		Remark
				Packet transfer mode			*Circuit transfer mode*						
				BER	***Priority***	***Packet size(length)***	*BER*	*Delay (PLMN)*	*Circuit mode*	*Packet mode*	connection type	symmetric / asymmetric	
3.	*(Definition -3: Paging Service) : - Data or Video or Voice message one-way transmission from fixed wireline service users and 2G / 3G users* *(Info. type) : Text, Voice, Video* *(Data Volume) :* *8kbit/s ~ 384kbit/s* *(Real / Non-Real) :* *Non-Real Time*	*Without Restriction*	*Packet transfer mode : up to 384 kbit/s* *Circuit transfer mode: min.8kbit/s, 16kbit/s 32kbit/s 64kbit/s 128kbit/s 256kbit/s 384kbit/s*	***min. 10^{-3}*** ***(min. 10^{-6} for 64/128/256/384kbit/s)***	***-unspecified (Best Effort type)*** ***or*** ***-Priority specified***		*min. 10^{-3}* *(min. 10^{-6} for 64/128/256/384kbit/s)*	*without restriction*	*- ISDN* *- other 3G* *- 2G PLMN* *- Internet* *- PSTN*	*- ISDN* *- other 3G* *- 2G PLMN* *- Internet* *- PSTN*	*PTP* *PTP* *Type: CL*	*Asymmetric* *Downlink only (*1)*	*(*1): In some case, to inform small message or data to the network, Uplink may be used. (Example: acknowledge of message reception)*

NOTE :

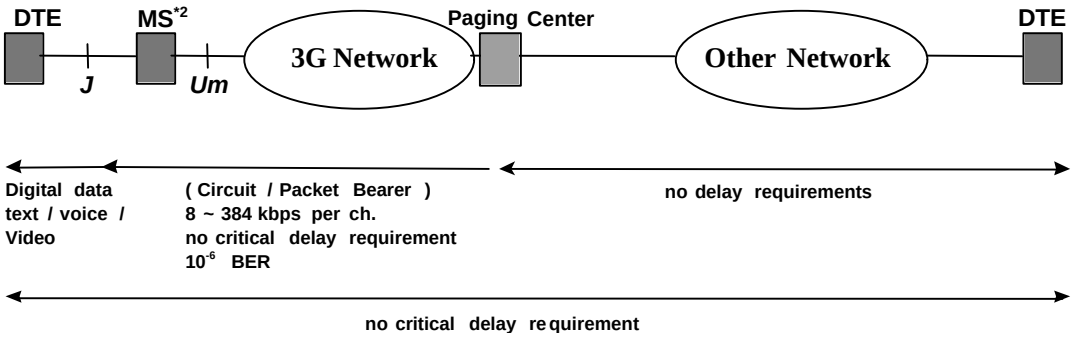
Some application may have a capability to keep required lower BER (e.g. 10^{-6}) by adopting additional error collection code. Such additional code and user data are multiplexed by those application side, not TRX.
In this case, the air channel which has BER=10^{-3} quality can be used for those application.
If the application does not have the above feature, the system should provide a BER=10^{-6} quality channel.

Network Model

Service : Mobile Specific Service (3-1)

<<Definition-3 : Paging Service>>

(Model -1 : associated with ISDN/Other 3G/PSTN/2G PLMN/Internet)



*1: Since Paging Service is a store-and-forward type service, various access methods for Paging Center can be selected depending on the intermediate network.

*2: Occasionally Paging service terminates at MS in 3G Network. Some Paging Service application allow direct communication between MS's.

QoS Table

Uploaing type (Monitoring type)

No.	Service Category	[Delay] (end-to-end)	*User Data rate*	*Bearer Capability*					Connected Network		Connection		Remark
				Packet transfer mode			*Circuit transfer mode*						
				BER	*Priority*	*Packet size(length)*	*BER*	*Delay (PLMN)*	*Circuit mode*	*Packet mode*	connection type	symmetric / asymmetric	
1.	*(Definition :* *Monitoring type service):* *- Service which sends data (including video) from one/multiple places to one place (voice and data can also be sent to opposite direction),* *Monitors remotely several places, etc.* *(Info. type):* *Voice, data,still picture and moving picture* *(Data Volume):* *64kbit/s~* *(Real / Non-Real):* *Quasi-Real Time* *Non-Real Time*	*The delay from user command to answer should be kept minimum*	*8kbit/s~2Mbit/s* *Uplink: 64kbit/s~ 2Mbit/s* *Downlink 8kbit/s~ 64kbit/s* *Packet transfer mode : up to 384 kbit/s* *Circuit Transfer mode:* *64kbit/s,* *128kbit/s* *256kbit/s* *384kbit/s*	*10^{-3}* *10^{-6}*	*-Priority requested (CBR*)* *or* *-unspecified (Best Effort type)*		*10^{-3}* *10^{-6}*	*- minimize response time for user command*	*- ISDN* *- Internet (PSTN)*	*- ISDN* *- Internet (PSTN)*	*MTP* *PTP* *Type: CO*	*Asymmetric* *Downlink :* *- Small* *Uplink* *-Large*	

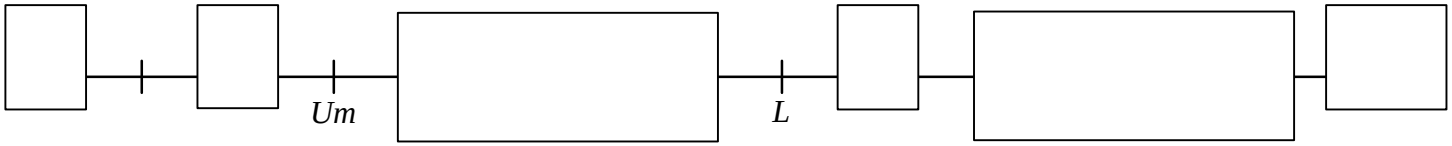
(*) CBR : Constant Bit Rate

NOTE :
Some application may have a capability to keep required lower BER (e.g. 10^{-6}) by adopting additional error collection code. Such additional code and user data are multiplexed by those application side, not TRX.
In this case, the air channel which has BER=10^{-3} quality can be used for those application.
If the application does not have the above feature, the system should provide a BER=10^{-6} quality channel.

Network Model

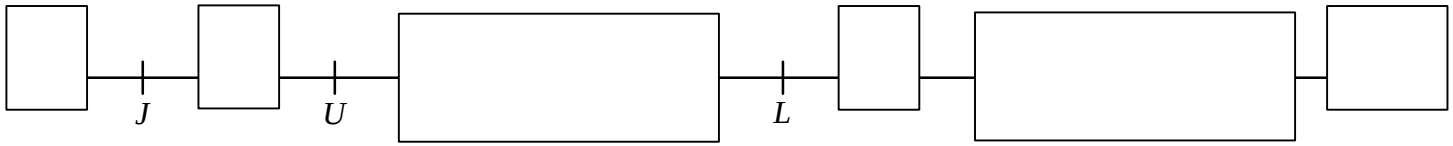
Service : Uploading Service

(Model -1 : Associated with ISDN : Circuit transfer mode)



Digital data image text voice	(Circuit / Packet Bearer) 8 ~ 2,048kbit/s per ch. Up-link : 64 ~ 2,048kbit/s Down-link : 8 ~ 64kbit/s no critical delay requirement 10^{-3} or 10^{-6} BER	no delay requirement
	end-to-end asymmetric no critical delay requirement	

(Model -2 : Associated with Internet : Packet transfer mode)



Digital data image text voice	(Circuit / Packet Bearer) 8 ~ 2,048kbit/s per ch. Up-link : 64 ~ 2,048kbit/s Down-link : 8 ~ 64kbit/s no critical delay requirement 10^{-3} or 10^{-6} BER	no delay requirement
	end-to-end asymmetric no critical delay requirement	

QoS Table

Data - Real Time, Bi-directional

No.	Service Category	[Delay] (end-to-end)	*User Data rate*	***Bearer Capability***					Connected Network		Connection		Remark
				Packet transfer mode			***Circuit transfer mode***						
				BER	***Priority***	***Packet size(length)***	***BER***	***Delay (PLMN)***	*Circuit mode*	*Packet mode*	connection type	symmetric / asymmetric	
1.	*(Definition - 1 : Data - Real Time, Bi-directional) :* *- Data transmission between 3G user and fixed network user or other 3G user.* *- Data should be transmitted in real time and the volume of each directional (upload, download) data is almost same.* *(Info. type):* *Data(Image, Audio, Data, Text)* *(Data Volume):* *8kbit/s ~ 2Mbit/s* *(Real / Non-Real):* *Real Time*	*minimize response time for user command*	*min. 8 kbit/s*	*10^{-3}* *10^{-6}*	***-Priority requested (CBR*)*** ***or*** ***-unspecified (Best Effort type)*** *(Priority selection depends on contents)*		*10^{-3}* *10^{-6}*	***- minimize response time for user command***	*- ISDN* *- Internet (PSTN) (other 3G)*	*- ISDN* *- Internet (PSTN) (other 3G)*	*PTP* *PTM* *Type: CO*	*Symmetric*	

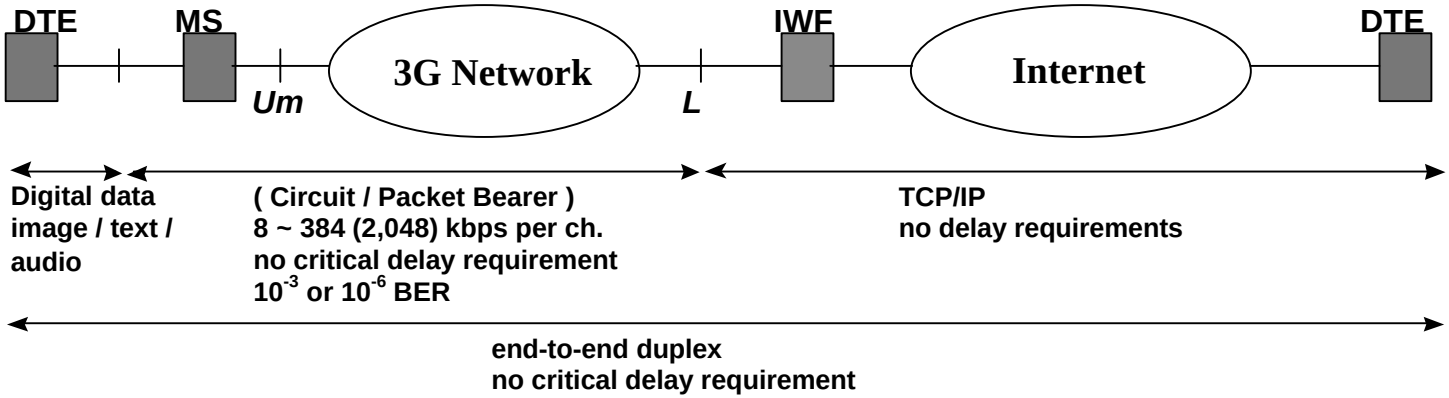
(*) CBR : Constant Bit Rate

NOTE :
Some application may have a capability to keep required lower BER (e.g. 10^{-6}) by adopting additional error collection code. Such additional code and user data are multiplexed by those application side, not TRX.
In this case, the air channel which has BER=10^{-3} quality can be used for those application.
If the application does not have the above feature, the system should provide a BER=10^{-6} quality channel.

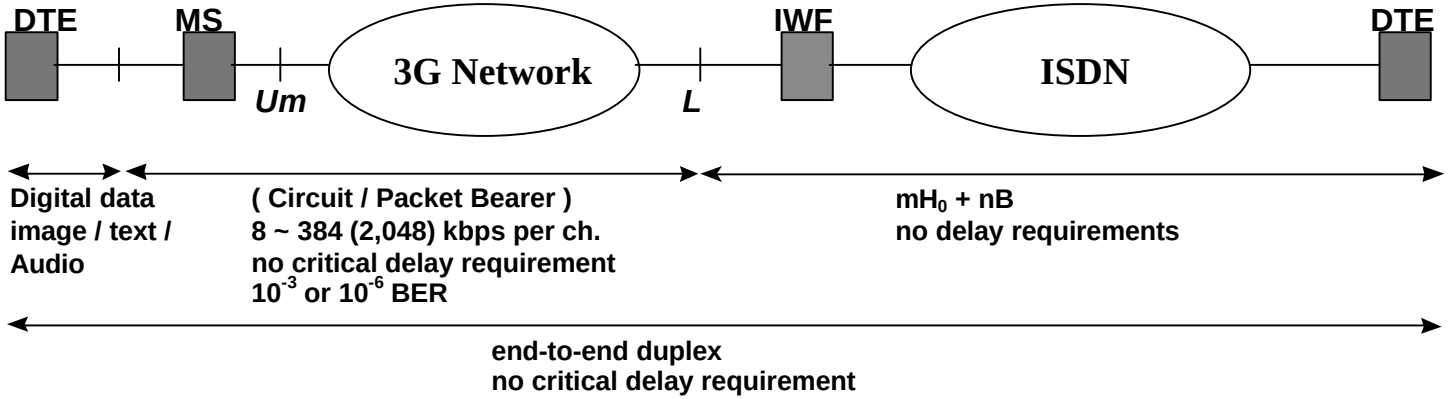
Network Model

Service : Data – Real Time, Bi-directional

(Model –1 : associated with Internet)



(Model -2 : associated with ISDN)



Note : In some cases, a 3G Network is connected to PSTN or other 3G networks.

Annex 5

Supplementary services for 3G mobile systems

The following tables contain possible supplementary services which are defined in ISDN, 2G mobile systems and requirements for FWA.

1. Number identification supplementary services

Table A5-1 Number identification supplementary services

Item	Reference	Service	Remark
Direct dial in (DDI)	(I.251.1) GSM GTS 02.95	Service enabling a user to dial another user directly on an ISPBX or a private network.	
Multiple subscriber number (MSN)	(I.251.2) GSM GTS 02.97	Service enabling assigning multiple ISDN numbers to one interface.	
Calling line identification presentation (CLIP)	(I.251.3) GSM GTS 02.81	Service which reports the calling user's number (including the sub-address if one exists) to the called user.	
Calling line identification restriction (CLIR)	(I.251.4) GSM GTS 02.81	Service which inhibits reporting of the calling user's number (including the sub-address if one exists) to the called user.	
Connected line identification presentation (COLP)	(I.251.5) GSM GTS 02.81	Service which reports the called user's number (including the sub-address if one exists) to the calling user.	
Connected line identification restriction (COLR)	(I.251.6) GSM GTS 02.81	Service which inhibits reporting of the called user's number (including the sub-address if one exists) to the calling user.	
Malicious call identification (MCI)	(I.251.7) GSM GTS 02.78	Service which allows the user to request the network to identify and memorize the information of the originator of the calls which are terminated by the user.	
Sub-addressing (SUB)	(I.251.8) GSM ETS 300 906	Service by which the network transparently transmits the sub-address between users.	
Automatic message box status indication	IS-53 FWA GSM GTS 02.03	Automatic message box status indication (e.g. new message, urgent message, empty) reduces loss of communication whilst a user is moving. (It informs enrolled subscribers when a voice message is available for retrieval.)	
Preferred Language	IS-53 GSM GTS 02.78	Preferred Language (PL) provides the subscriber the ability to specify the language for network services.	

2. Call offering supplementary services

Table A5-2 Call offering supplementary services

Item	Reference	Service	Remark
Call transfer (CT) / Explicit Call Transfer (ECT)	(I.252.1) GSM GTS 02.91	Service which allows the user to transfer an active call to a third party. This service applies to both originating calls and terminating calls. It also differs from the call forwarding service (which transfers a call from the called party before call establishment).	
Call forwarding busy (CFB)	(I.252.2) GSM GTS 02.82	Service whereby a call is forwarded to another user when the called user is busy. The served user's originating service is unaffected.	
Call forwarding no reply (CFNR)	(I.252.3) GSM GTS 02.82	Service whereby an unanswered call to a user is forwarded to another user. The served user's originating service is unaffected.	
Call forwarding unconditional (CFU)	(I.252.4) GSM GTS 02.82	Service whereby the network forwards the call of a registered user to another user, regardless of the condition of the termination.	
Call deflection (CD)	(I.252.5) GSM GTS 02.72	A service which upon receiving a call, allows the user to choose if the call should be forwarded to another user or not.	
Line hunting (LH)	(I.252.6)	Service which enables reception of a call by using a specific number of an interface featuring multiple channels and numbers.	
Call forwarding no page response	STD-27F GSM GTS 02.82	A mobile communication specific service which forwards all incoming calls or incoming calls of specified basic service to another user when a paging response is not received.	
Call forwarding not registered	STD-27F GSM GTS 02.82	A mobile communication specific service which forwards all incoming calls or incoming calls of specified basic service to another user when the location registration of the MS is not registered.	
Call forwarding no radio resource	STD-27F GSM GTS 02.82	A mobile communication specific service which forwards all incoming calls or incoming calls of specified basic service to another user when the radio-frequency channel is congested.	
Voice messaging function	STD-27F	Function which on alerting, transfers the call to a voice messaging equipment to record a message instead of answering the call.	
Separation of answering from alerting	IS-53	The called 3G Mobile System user will be able to use any terminal of their choice (e.g. telephone or personal station	

Item	Reference	Service	Remark
Flexible Alerting	IS-53 GSM GTS 02.78	Flexible Alerting (FA) causes a call to a Pilot Directory Number to branch the call into several legs to alert several termination addresses simultaneously. The mobile telephones in the group may be alerted using distinctive alerting. Additional calls may be delivered to the FA Pilot Directory Number at any time. The first leg to be answered is connected to the calling party. The other call legs are abandoned.	
Mobile Access Hunting	IS-53 GSM GTS 02.78	Mobile Access Hunting (MAH) causes a call to a Pilot Directory Number to search a list of termination addresses sequentially for one that is idle and able to be alerted. If a particular termination address is busy, inactive, fails to respond to a paging request, or does not answer alerting before a time-out, then the next termination address in the list is tried. Only one termination address is alerted at a time. The mobile telephones in the group may be alerted using distinctive alerting. Additional calls may be delivered to the MAH Pilot Directory Number at any time.	
Voice Message Retrieval	IS-53 GSM GTS 02.03	Voice Message Retrieval (VMR) permits a subscriber to retrieve messages from a voice message system (VMS).	
Interception	FWA	[TBD]	
Follow me	FWA	[TBD]	
Virtual Answer Machine	FWA	[TBD]	
Absent Subscriber Service	FWA	[TBD]	
Automatic Alarm call service	FWA	[TBD]	
Answer holding	STD-27F	Service which holds a incoming call and notifies it to the calling user when the called user cannot answer the incoming call immediately.	

3. Call completion supplementary services

Table A5-3 Call completion supplementary services

Item	Reference	Service	Remark
Call waiting (CW)	(I.253.1) GTS 02.83	Service which notifies the user of an incoming call (upon a call basis) when no traffic channel is available.	
Call hold (HOLD)	(I.253.2) GTS 02.83	Service which interrupts the existing call by setting it to the "hold" state. The held call may be reactivated if desired. After the call is interrupted, the traffic channel used for the call may be set on hold for use by newly incoming call.	

Completion of calls to busy subscribers (CCBS)	(I.253.3) GSM GTS 02.93	When the called user is busy, the network realerts the called user after it becomes idle. When the called user is available for the call, the network reports this to the originating user and may subsequently set up a call if necessary.	
Automatic Recall When Free	FWA	[TBD]	
Faultmans Ring Back	FWA	[TBD]	
Call Queuing to a Single Line	FWA GSM GTS 03.01	[TBD]	

4. Multiparty supplementary services

Table A5-4 Multiparty supplementary services

Item	Reference	Service	Remark
Conference calling (CONF)	(I.254.1) GSM GTS 02.84	Service which enables the user to communicate with several other users simultaneously.	
Three-party service (3PTY)	(I.254.2) GSM GTS 02.84	Service which allows the user to hold the active call and make an additional call to the third user. It subsequently allows switching between the two calls, and/or the release of one call while maintaining the other. Optionally, this service enables the conference calling so that all three parties can talk simultaneously.	

5. Community of interest supplementary services

Table A5-5 Community of interest supplementary services

Item	Reference	Service	Remark
Closed user group (CUG)	(I.255.1) GSM GTS 02.85	Service which enables users to form a group to/from which user access is restricted. One user can be a member of one or more CUGs. Generally, a member user of a CUG can only communicate with other users in the same CUG, and cannot communicate with users outside the group. Specific CUG members are additionally allowed to originate calls outside the group or terminate calls from outside the group.	
Private numbering plan (PNP)	(I.255.2) GSM GTS 02.95	Service which allows users to originate or terminate calls using user defined private numbers.	
User Group ID	IS-53	User Group ID (UGID) allows for a number of MSs to register for operation within a specific user group. This group of MSs, when tuned to the same Digital Control Channel on a system, can be alerted as a group (i.e., simultaneously).	

Item	Reference	Service	Remark
Voice Group Call Service (VGCS)	GSM ETS 300 926	The VGCS enables a calling subscriber to establish a voice group call to destination subscribers belonging to a predefined group call area and group ID.	
Voice Broadcast Service (VBS)	GSM ETS 300 926	The VBS enables a calling subscriber to send speech unidirectional and simultaneously to all entitled dispatchers and to destination subscribers belonging to a predefined group call area who have a subscription to the applicable group ID.	

6. Charging supplementary services

Table A5-6 Charging supplementary services

Item	Reference	Service	Remark
Credit card calling (CRED)	(I.256.1) GSM GTS 02.78	Service which puts call charges on a credit card account.	
Advice of charge (AOC)	(I.256.2) GSM GTS 02.86	Service which advises the user of charging information on a call-by-call basis.	
Reverse charging (REV)	(I.256.3) GSM GTS 02.78	Service which puts call charges on the called party upon request by the originating party and at the consent of the called party .	
Private Metering	FWA	[TBD]	
Detailed Charging	FWA GSM GTS 02.78	[TBD]	
Advice of Charge (Accumulated)	GSM GTS 02.86	Service which advises the user of charging information accumulated on the performed calls	

7. Additional information transfer supplementary services

Table A5-7 Additional information transfer supplementary services

Item	Reference	Service	Remark
User-to-user signalling (UUS)	(I.257.1) GTS 02.87	Service which allows the user to transfer the user-to-user information through the signalling channel in association with the call.	

8. Origination and termination restriction supplementary services

Table A5-8 Origination and termination restriction supplementary services

Item	Reference	Service	Remark
Barring of all Outgoing Calls / Barring of all Outgoing International Calls / Barring of all Outgoing Calls Except to the Hone PLMN	STD-27F GSM GTS 02.88	Service which restricts outgoing calls based on the called party number or the location of the called terminal. This service can be set for all or for specified basic services. However, it does not restrict termination of a call and origination of an emergency call.	
Barring of all Incoming calls / Barring of all incoming Calls When Roaming Outside the Home PLMN	STD-27F FWA GSM GTS 02.88	Service which restricts incoming calls. This service is set for all or for specified basic services. Outgoing calls from a terminal are not restricted.	
Do Not Disturb	IS-53 GSM GTS 02.88	Do Not Disturb (DND) prevents a called subscriber from receiving calls. When this feature is active, no incoming calls shall be offered to the subscriber. DND also blocks other alerting, such as the Call Forwarding Unconditional abbreviated (or reminder) alerting and Message Waiting Notification alerting.	
Selective Call Acceptance	IS-53 GSM GTS 02.78	Selective Call Acceptance (SCA) is a call screening service that allows a subscriber to receive incoming calls only from parties whose Calling Party Numbers (CPNs) are in an SCA screening list of specified CPNs. Calls from CPNs not on the SCA screening list and calls without a CPN shall be given call refusal treatment while SCA is active. The SCA screening list is a set of CPNs that shall be permitted to terminate to the called subscriber.	
Restricted Mobility	FWA	Some form of mobility restriction is needed. Mobility restriction shall be based on the terminal location.	
Restricted Access to B subscriber	FWA	[TBD]	
Inhibition of Forwarded Calls	FWA	[TBD]	

9. Priority services

Table A5-9 Priority services

Item	Reference	Service	Remark
Priority connection and channel hold	STD-27F GSM ETS 300 924	Service which allows the following operation by setting priority classes to an MS. 1) If an MS or a terminal of higher priority class originates a call when all radio CHs are busy, a radio-frequency channel used for an MS or a terminal of lower priority class is disconnected for subsequent use for higher priority class. 2) The radio-frequency channel used for the higher priority or important communication is held after such communications have been completed.	
Priority Access & Channel Assignment	IS-53 GSM ETS 300 924	Priority Access and Channel Assignment (PACA) allows a subscriber to have priority access to voice or traffic channels on call origination. This feature permits a subscriber to obtain priority access to voice or traffic channels by queuing these subscribers' originating calls when channels are not available. When a channel becomes available, the queued subscriber is served on a first come first served and a priority basis.	

Item	Reference	Service	Remark
Enhanced Multi-Level Precedence and Pre-emption service.	GSM ETS 300 924	The enhanced Multi-Level Precedence and Pre-emption service provides different levels of precedence for call setup and for call continuity in case of handover. The maximum precedence level of a subscriber is set at the subscription time by the service provider, based on the subscriber's need. The subscriber may select a precedence level up to and including the maximum precedence level subscribed to, on a per call basis. There are at maximum 7 priority levels. The two highest levels are reserved for network internal use, e.g. for emergency calls or the network related service configurations for specific voice broadcast or voice group call services. These two levels can only be used locally, i.e. in the domain of one MSC. The other five priority levels are offered for subscription and can be applied globally, e.g. on inter switch trunks, if supported by all related network elements, and also for interworking with ISDN networks providing the MLPP service. The priorities in the network shall be treated differently for the following call scenarios: • mobile originated calls • mobile terminated calls • mobile-to-mobile in case of roaming • mobile-to-mobile calls in one network • voice broadcast and voice group calls The call setup times are also categorized into three classes.	

10. Security and Privacy services

Table A5-10 Security and Privacy services

Item	Reference	Service	Remark
Transaction Security	FWA GSM ETS 300 920	FWA system should have support for authentication, security and crypting for data applications. By providing secure transactions for applications, FWA can support directly monetary applications like payphones.	
End-to-end encryption	IS-53 GSM ETS 300 920	The 3G Mobile System should support the use of end-to-end encryption associated with any service that uses an unrestricted circuit transfer mode or packet transfer mode bearer service. As a supplementary service should also support end-to-end encryption of speech by the use of an unrestricted circuit transfer mode bearer via the ISDN.	
Password Call Acceptance	IS-53 GTS 02.78	Password Call Acceptance (PCA) is a call screening feature that allows a subscriber to limit incoming calls to only those calling parties who are able to provide a valid PCA Password (i.e., a series of digits). Calls from parties who cannot provide a valid PCA Password shall be given call refusal treatment while PCA is active. PCA provides a method for screening incoming calls while providing access to the subscriber from a calling party using any terminal or phone.	
Subscriber PIN Access & Intercept	IS-53 GTS 02.78	The Subscriber PIN Intercept (SPINI) feature enables a subscriber to restrict outgoing call origination usage of their mobile. The subscriber is required to enter a SPINI Personal Identification Number (PIN) authorization code (i.e., a subscriber-specific string of digits) in order to originate calls meeting a specified criteria (e.g., local call type). If the correct SPINI PIN authorization code (or, simply, PIN) is entered, call originations are allowed. If an invalid SPINI PIN is entered, call originations shall be given denial treatment (e.g., an announcement indicating the reason for denial). Calls so denied may, optionally, be logged.	
Procedure for the Change of Keyword	FWA	[TBD]	
Signaling information element confidentially	GSM ETS 300 920	The Signaling information element confidentially feature is the property that a given piece of signaling information which is exchanged between MSs and base stations is not made available or disclosed to unauthorized individuals, entities or processes.	

11. Feature control and Interrogation services

Table A5-11 Feature control and Interrogation services

Item	Reference	Service	Remark
Remote Feature Control	IS-53	Remote Feature Control (RFC) permits a calling party to call a special RFC Directory Number, identify itself as an authorized subscriber with a mobile Directory Number and an RFC Personal Identification Number (PIN), and to specify one or more feature operations. This service is accessible from any mobile or landline station.	
Voice Controlled Services	IS-53	Voice Controlled Services (VCS) are a family of services that employ voice recognition technology to allow the cellular wireless user to control features and services using spoken commands. The following Stage 1 service descriptions apply to network-based VCS only. The following service descriptions do not apply to terminal-based VCS (services which employ voice recognition technology in the MS).	
Feature Status Check	FWA	[TBD]	
Network Identity and Time-zone	GTS 02.42	This feature provides the means for serving PLMNs to transfer current identity and the local timezone to mobile stations, and for the mobile stations to store and use this information.	

12. Smart dialing services

Table A5-12 Smart dialing services

Item	Reference	Service	Remark
Abbreviated dialling	FWA GSM ETS 300 906	[TBD]	
Last Number Repetition	FWA GSM ETS 300 906	[TBD]	
Immediate Fixed Destination Call	FWA GSM ETS 300 906	[TBD]	
Immediate Fixed Destination Call with Time Supervision	FWA	[TBD]	
Automatic calling	GSM ETS 300 906	This feature provides that calls can be initiated automatically from the MS.	

Item	Reference	Service	Remark
Service Dialing numbers	GSM ETS 300 906	This feature allows for the storage of numbers related to services offered by the network operator/service provider in the SIM (e.g. Customer Care). The user can use these numbers to make outgoing calls, but the access for updating these numbers shall be under the control of the operator.	

13. Mobile bearer specific services

Table A5-13 Mobile bearer specific services

Item	Reference	Service	Remark
Voice/non-Voice switching	STD-27F	The non-voice communication switching function provides non-voice communication service such as FAX, MNP modem by a request from the user during voice communication.	
DTMF signal transmission	STD-27F	The DTMF signal transmission service is used to transfer the DTMF signal from the mobile station. The DTMF number for the DTMF button pressed by the user is sent to the network in a CC message and the network generate the DTMF signal.	
Emergency Calls	GSM ETS 300 905	The land mobile system is capable of efficient handling of emergency calls from the mobile station. The emergency call shall be routed automatically to an appropriate emergency center based on the geographical location of the mobile station.	
Alternate Speech/Facsimile G3	GSM ETS 300 905	This service allows the connection of CCITT group 3 fax apparatus (send and/or receive) to the mobile stations.	
Unstructured Supplementary Service Data	GSM GTS 02.90	This feature transfers non-standardized data of standardized supplementary services between the network and the mobile station.	

14. Operator supplementary services

Table A5-14 Operator supplementary services

Item	Reference	Service	Remark
Operator determined barring of all outgoing calls	GSM FWA GTS 02.41	[TBD]	
Operator determined barring of outgoing international calls	GSM FWA GTS 02.41	[TBD]	
Operator determined barring of outgoing premium rate, entertainment, calls	GSM FWA GTS 02.41	[TBD]	
Operator determined barring of outgoing premium, information, calls	GSM FWA GTS 02.41	[TBD]	
Supplementary service access barred	GSM ETS 300 919	Prevents user control of any supplementary service (registration, erasure, activation, deactivation, user invocation, interrogation). A large number of variants of this service can be standardised.	

Home PLMN-specific	GSM GTS 02.41	Four different operator specific barring services can be defined by each operator.	
Operator determined barring of outgoing calls except those to the home PLMN country	GSM GTS 02.41	[TBD]	
Regional subscription	GSM GTS 09.02	Enables the operator to limit roaming of subscribers. Can e.g. be used for defining different subscription categories (international, national, regional, local etc.) using different subscription fees or user tariffs for different subscription categories.	
Event tracing	GSM	[Description to be added.]	
Service portability	GSM GTS 02.78	This service feature provides the capability for operator specific services even when the subscribers are roaming into visiting networks.	
Supplementary Service Control	GSM ETS 300 907	The subscriber's supplementary services are controlled with Man-Machine procedures, such as activation, deactivation, interrogation, registration and erasure.	

15. Multiple Subscriber Profile

Table A5-15 Multiple Subscriber Profile

Item	Reference	Service	Remark
Multiple Subscriber Profile	GTS 02.97	This is a service to enable mobile subscribers to have several profiles associated with a single SIM and a single IMSI, with each profile being a subscription option. This will allow the subscriber to separate her telecommunication service needs into different identities (e.g. business and home).	

Annex 6

Service Accessibility Design Constraints

(ANNEX 3, ITU-R M.1034)

This Annex includes provisional service accessibility design constraints on 3G Mobile System radio interfaces across 3G Mobile System radio operating environments. The entries in Table A6-1 represent the set of possible services to be provided in any given environment in terms of information types and user bit rates and are only defined as a basis for the overall optimisation of the design of 3G Mobile System radio interface(s) and their characteristics. 3G Mobile System should have capabilities of dealing in an integrated way with different multiple information types of provision of bearer services, and of interconnection with ISDN although there may be the restrictions that will come from a mobile communication operating environment. Note that the exact set of services to be provided by a particular system in a given environment, and hence the particular design constraints for the radio interface for that system, shall be decided by the 3G Mobile System service providers and/or operators.

TABLE A6-1

Service accessibility design constraints on 3G Mobile System radio interface(s) across 3G Mobile System radio operating environments

Service information Type	Typical source bit rate (kbit/s)	Cellular Coverage	Radio operating environment												
		Typical radio coverage	(1) Bus. ind.	(2) Nei. i/o.	(3) Home ind.	(4) Urban veh.	(5) Urban ped.	(6) Rural out.	(7) Terr. aero	(8) Fixed out.	(9) Local h/r.	(10) Urban sat.	(11) Rural sat.	(12) Fixed sat.	(13) Ind. sat.
		Max. bit rate	2000	384	2000	144	384	[384]	[144]	384	[2000] (Note3)	[144]	[144]	[384]	[32]
Speech service															
Telephony	2.4-16	Contiguous	yes	yes	yes	yes	yes	yes	yes	Yes	–	yes	yes	yes	–
Hi Quality	16-64	Island	yes	yes	yes	yes	yes	yes/no	–	yes	–	yes/no	yes/no	yes	–
Audio service															
Hi Quality (AM)	16-64	Contiguous	yes	yes	yes	yes	yes	yes	yes	Yes	–	yes	yes	yes	–
Hi Fi Audio Broadcasting, Hi Quality (FM)	32	Contiguous	yes	yes	yes	yes	yes	yes	yes	yes	-	yes	yes	yes	-
	64, 128, 144	Contiguous	yes	yes	yes	yes	yes	yes/no	yes/no	yes	-	yes/no	yes/no	yes	-
	384	Island/Spot	yes	yes	yes	-	yes	yes/no	-	yes	yes	-	-	yes	-
Video service															
Real time Bi-directional (TelQ)	16	Contiguous	yes	yes	yes	yes	yes	yes	yes	yes	-	yes	yes	yes	yes
	64, 128, 144	Contiguous	yes	yes	yes	yes	yes	yes/no	yes/no	yes	-	yes/no	yes/no	yes	-
Real time Bi-directional (TelQ/HQ)	384	Island/Spot	yes	yes	yes	–	yes	yes/no	–	yes	yes	–	–	yes	-
	[768, 2000]		[yes]	[-]	[yes]	[-]	[-]	[-]	[-]	[-]	[yes]	[-]	[-]	[-]	[-]
Real time Bi-directional (HQ)	16-32	Contiguous	yes	yes	yes	yes	yes	yes	yes	yes	-	yes	yes	yes	yes
Streamline	64, 128, 144	Contiguous	yes	yes	yes	yes	yes	yes/no	yes/no	yes	-	yes/no	yes/no	yes	-
	384	Island/Spot	yes	yes	yes	-	yes	yes/no	-	yes	yes	-	-	yes	-
	[768, 2000]		[yes]	[-]	[yes]	[-]	[-]	[-]	[-]	[-]	[yes]	[-]	[-]	[-]	[-]
Video and Data service															
Real/non real time uploading	64, 128, 144	Contiguous	yes	yes	yes	yes	yes	yes/no	yes/no	yes	-	yes/no	yes/no	yes	-
	384	Island/Spot	yes	yes	yes	–	yes	yes/no	–	yes	yes	–	–	yes	-
	[768, 2000]		[yes]	[-]	[yes]	[-]	[-]	[-]	[-]	[-]	[yes]	[-]	[-]	[-]	[-]

Data service															
Real time Bi-directional	8 - 16	Contiguous	yes	yes	yes	yes	yes	yes	yes	yes	-	yes	yes	yes	yes
	64, 128, 144	Contiguous	yes	yes	yes	yes	yes	yes/no	yes/no	yes	-	yes/no	yes/no	yes	-
	384	Island/Spot	yes	yes	yes	–	yes	yes/no	–	yes	yes	–	–	yes	-
	[768, 2000]		[yes]	[-]	[yes]	[-]	[-]	[-]	[-]	[-]	[yes]	[-]	[-]	[-]	[-]
Data application	8-16	Contiguous	yes	yes	yes	yes	yes	yes	yes	yes	-	yes	yes	yes	yes
	64, 128, 144	Contiguous	yes	yes	yes	yes	yes	yes/no	yes/no	yes	-	yes/no	yes/no	yes	-
	384	Island/Spot	yes	yes	yes	-	yes	yes/no	-	yes	yes	-	-	yes	-
	[768, 2000]		[yes]	[-]	[yes]	[-]	[-]	[-]	[-]	[-]	[yes]	[-]	[-]	[-]	[-]
Voice band	-64	Contiguous	yes	yes	yes	yes	yes	yes	yes	yes	-	yes	yes	yes	yes
Image service															
G3 facsimile	33.6	Contiguous	yes	yes	yes	yes	yes	yes/no	yes/no	yes	–	yes/no	yes/no	yes	–
Mobile specific service															
Location	-8	Contiguous	yes	yes	yes	yes	yes	yes	(Note4)	(Note4)	–	yes	yes	(Note4)	yes
Short message	-8	Contiguous	yes	yes	yes	yes	yes	yes	yes	yes	-	yes	yes	yes	yes
Paging	–8, 8-32	Contiguous	yes	yes	yes	yes	yes	yes	yes	yes	-	yes	yes	yes	yes
	64, 128, 144	Contiguous	yes	yes	yes	yes	yes	yes/no	yes/no	yes	-	yes/no	yes/no	yes	-
	384	Island/Spot	yes	yes	yes	-	yes	yes/no	-	yes	yes	-	-	yes	-
	[768, 2000]		[yes]	[-]	[yes]	[-]	[-]	[-]	[-]	[-]	[yes]	[-]	[-]	[-]	[-]
Specific dispatch	-8, 8-16	Contiguous	yes	yes	yes	yes	yes	yes	yes	yes	-	yes	yes	yes	yes
Internet access service	8 – 16	Contiguous	yes	yes	yes	yes	yes	yes	yes	yes	-	yes	yes	yes	yes
	64, 128, 144	Contiguous	yes	yes	yes	yes	yes	yes/no	yes/no	yes	-	yes/no	yes/no	yes	-
	384	Island/Spot	yes	yes	yes	–	yes	yes/no	–	yes	yes	–	–	yes	-
	[768, 2000]		[yes]	[-]	[yes]	[-]	[-]	[-]	[-]	[-]	[yes]	[-]	[-]	[-]	[-]

Radio operating environments:

(1) Bus. ind.: business indoor environment.
(2) Nei. i/o.: neighbourhood indoor/outdoor environment.
(3) Home ind.: home indoor environment.
(4) Urban veh.: urban vehicular outdoor environment.
(5) Urban ped.: urban pedestrian outdoor environment.
(6) Rural out.: rural outdoor environment.
(7) Terr. aero: terrestrial aeronautical environment.
(8) Fixed out.: fixed outdoor environment.
(9) Local h/r.: local high bit rate environment.
(10) Urban sat.: urban satellite environment.
(11) Rural sat.: rural satellite environment.
(12) Fixed sat.: satellite fixed-mounted environment.
(13) Ind. sat.: indoor satellite environment.

Notes to Table A6-1:

NOTE 1 – Satellite aeronautical and maritime radio operating environments are currently assumed to be included in the various satellite environments.

NOTE 2 – A “yes” entry for a particular radio operating environment implies that either all, or a subset, of the typical source bit rates indicated will be supported.

NOTE 3 – Bit rate higher than 2 Mbit/s is for further study.

NOTE 4 – Not applicable. Location can be identified without the location service.

Annex 7

Additional information about the FWA requirements

1 FWA based on Mobile System

The FWA based on Mobile System should be based on the standard mobile network and Mobile services Switching Centre (MSC). This solution basically comprises of the following network elements: Mobile services Switching Centre, Radio Network Controller (RNC), Base Station (BS), fixed cellular subscriber units, known as FWA terminals and Terminal equipments (TE). From the system point of view, interfaces to the end-user terminals (e.g. telephone, facsimile machine, personal computer, etc.) and network management system are included. In this system solution, the Mobile services Switching Centre (MSC) operates as a service node.

FWA based on Mobile System should be implemented by using the network provided by the 3G Mobile System. FWA system includes a possibility to provide services to both fixed and mobile users. This is important requirement as already pointed out in ITU-R M.819-2 . Open, standard interfaces are used in both network interface and the customer interfaces. This enables, on one hand, switch vendors easily to build independent switching and radio networks and on the other hand, end-users to use standard equipments like telephone sets, fax machines,personal computers etc. It is recommended to use the standard 3G Mobile System interfaces, because of economies of scale. 3G Mobile System infrastructures, in particular base station equipment, can be fully utilized in the FWA based on Mobile System solution.

2 FWA based on Access System

The FWA based on Access System comprises of the FWA Access Node, the standard Base Stations (BS), FWA stations and standard Terminal Equipment. From the system point of view, the interfaces towards the service node (SN), terminal equipment (TE) (e.g. telephone, facsimile machine, personal computer, etc.) and network management system are offered. FWA system includes a possibility to provide services to both fixed and mobile users. This is important requirement as already pointed out in ITU-R M.819-2.

Open, and standard interfaces are used in both network interface and the customer interfaces. This enables, on one hand, switch vendors easily to build independent access networks and on the other hand, end-users to use standard equipments like telephone sets, fax machines, personal computers, etc. It is recommended to use the standard 3G Mobile System air interface and the standard 3G Mobile System system internal interfaces, and because of economies of scale, the base station equipment can be fully utilized also in this FWA based on Access System.

3 FWA Call Set-Up Procedures

In the transparent mode the transmission path is established between the FS and the switch (Service Node or AMSC) by off-hook ensuring that the user that the speech path is already

connected before dialling. Also call set-up procedure is faster in transparent mode. This important because FWA system should provide the look and feel of PSTN network. In non-transparent mode dial tone comes from FWA terminal. Non-transparent call set-up mode has longer call set-up times and a drawback that it is not ensured that the speech path is already connected before dialling. However, in non-transparent mode it is faster to get dial tone because it comes from FWA terminal.

4 Hook-flash and DTMF tone transmitter

DTMF tone transmission should be done in digital format using associate control channel.

5 Voice-band data and Facsimile

Voice-band data transmission should be done either in digital format using a traffic channel, or in waveform using PCM coding.

6 Network Management

Network management of FS is carried mainly by Access Node related functions/elements in the FWA based on Access System and by MSC related functions/elements in the FWA based on Mobile System and includes elements up to fixed station.

Control and Maintenance (C&M) of FWA terminal is done by using 3G Mobile System's SMS (Short Message Service) or related slow bitrate media, as a carrier. C&M of FWA terminal is seen as an application of SMS service. Figure 1 shows basic (high level) principles of C&M.

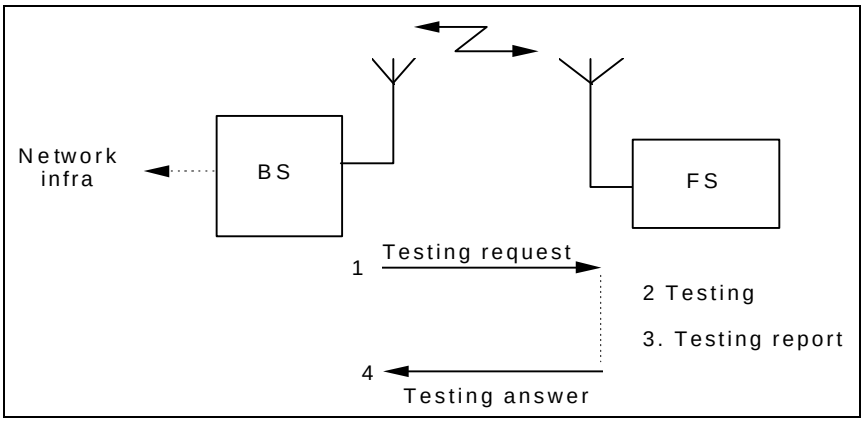


Figure 1. Example of Control and Maintenance function.

Annex 8

"Security" Design Principle

1. Status of Issuing this Design Principle

IMT-2000 standard, which is currently being drafted as specification version 1, is targeted to finalize by April 1999. Security Algorithm standard is one of the items. How to proceed the study procedure for drafting Security Algorithm standard was discussed at the 2nd and 5th System WG meetings in 1998 to basically approve the following two procedures:

1) Security Algorithm standard
   Based on general documentation rules, each of Air, BS-MSC, MS-UIM, and [Abis] interfaces and specification of MS and BS should be separately documented for standardization.
   However, because the content of the Security Algorithm standard is limited, and because the Security Algorithm standard includes confidential matters even in the process of documentation, the Security Algorithm standard shall be documented in a separate volume.
2) Study procedure
   The matter shall be studied in two stages. In the Stage 1, the SDP AdHoc (Security Design Principle AdHoc) group is set up and it issues the security design principle. In the Stage 2, specifications including algorithms are drafted.
   The SDP AdHoc, which was positioned as an AdHoc under control of IMT-2000 Study Committee System WG and which was active from August 1998 to November 1998, documented this principle.

2. Target Security and Privacy Features

2.1 Scope of Standardization

The scope of standardization is shown below.
Note that, considering evolution from the 2nd generation to 3rd generation system, work is divided into Phase 1 and 2:

- Phase 1: Study security based on both GSM and ANSI because TTC is studying security flow based on both GSM- and ANSI-evolution approaches and because the connection to the existing core networks is considered to be important in ITU-T.
- Phase 2: The next phase, in which e.g. authentication using public key mechanism or version management of security data/mechanisms shall be used to consciously minimize the required effort.

(Description on symbols)
❍: Standardized; Δ: Standardized conditionally; X: Out of scope of standardization;
?: Whether or not there is any subject of standardization is not known

1) Phase 1

Table A8-1 Scope of Standardization in Phase 1

Item no.	Item	Mechanism	Algorithm	Key Generation Algorithm
1	User Identity Authentication	❍	Δ Note1	Δ Note1
2	Re-authentication of Users	❍	Δ Note1	Δ Note1
3	Network Operator / Service Provider Authentication	❍	Δ Note1	Δ Note1
4	User Data Confidentiality	❍	❍	Δ Note1
5	Signalling Information Confidentiality	❍	❍	Δ Note1
6	User Identity Confidentiality (temporary ID)	❍	X	X
7	User Location Confidentiality	❍	X	X
8	Access Control for Subscription and Service Profile Data	X	X	X
9	Version Control of Security Data and Mechanisms	❍ Note4	X	X
10	Writing subscriber data to UIM	Δ Note5	Δ Note5	Δ Note5
11	Emergency Call	❍ Note7	❍ Note7	❍ Note7

1) Phase 2

(Shaded parts in Table A8-2 mean items changed from Phase 1. This table shows the case where the version management of security data/mechanisms is conducted so that standardization is consciously minimized. In case of an authentication using public key mechanism, for example, classification may differ from one below.)

Table A8-2 Scope of Standardization in Phase 2

Item no.	Item	Mechanism (Information Flow Level)	Algorithm	Key Generation Algorithm
1	User Identity Authentication	X Note6	X Note6	X Note6
2	Re-authentication of Users	X Note6	X Note6	X Note6
3	Network Operator / Service Provider Authentication	X Note6	X Note6	X Note6
4	User Data Confidentiality	X Note6	X Note6	X Note6
5	Signalling Information Confidentiality	X Note6	X Note6	X Note6
6	User Identity Confidentiality (temporary ID)	X Note6	X	X
7	User Location Confidentiality	? Note2	? Note2	? Note2
8	Access Control for Subscription and Service Profile Data	? Note3	?	?
9	Version Control of Security Data and Mechanisms	❍ Note4	?	?
10	Writing subscriber data to UIM	Δ Note5	Δ Note5	Δ Note5
11	Emergency Call	❍	❍	❍

Note 1: This depends on UIM implementation (IC card/built-in type) and which system is the base.

Note 2: This item is not necessary if the user location confidentiality function can be enabled with air interface confidentiality and a temporary ID.

Note 3: This item is not necessary in cases where this function is defined as the data downloading function to UIM by OTA (Over the Air) and the function of accessing

subscriber database due to activation, change or deactivation of supplementary services, because security can be guaranteed with the signalling information confidentiality on the air interface.

Note 4: In Phase 1, functions to provide the basic services are specified. In Phase 2, controlling the other security mechanism/algorithm is possible.

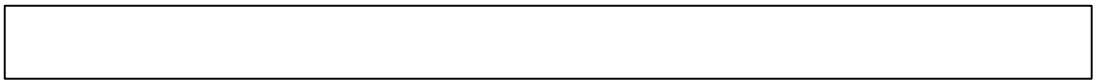
Note 5: Whether this is standardized or not depends on UIM implementation. (IC card/built-in type etc.) (Not standardized in case of IC card, while standardized in case of built-in type)

Note 6: There is no need for standardization if the version management function of security data and mechanisms is implemented.

Note 7: It is required to study the mechanism and algorithm of emergency call according to the UIM status.

2.2 Model Diagram

2.2.1 Overall Model Diagram



Note) UIM : User Identity Module, MS : Mobile Station, RAN : Radio Access Network,
CN : Core Network
H : Home, V : Visited (a visited network, including home network.)

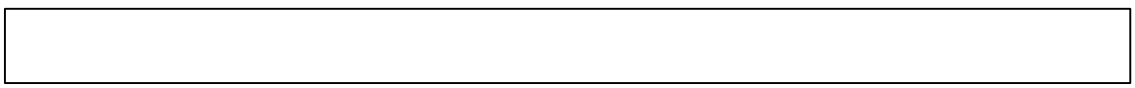
2.2.2 Model for Data Writing to UIM/MS

1) Removable UIM

[Basic 1] Data writing with writing device

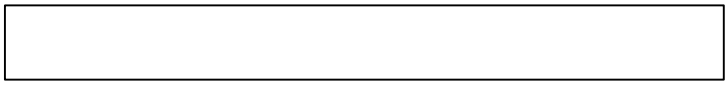
Note: In this model, the writing device is a dedicated device for each UIM.
The section between writing device and HLR shall not be subject to study.
HLR: Home Location Register

[Extended 1] Data writing with OTA



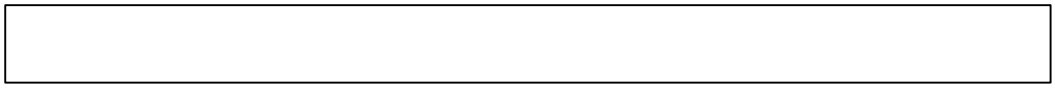
2) Non-Removable

[Basic 1] Data writing with writing device



Note: The section between writing device and HLR shall not be subject to study.

[Basic 2] Data writing with OTA



2.3 Authentication

2.3.1 User Identity Authentication

2.3.1.1 Authentication Algorithm

1) It is required to adopt a highly secure algorithm. (Key length and security against cryptanalysis should be also considered.)
2) Algorithm information shall not be disclosed at a roaming network, at the air interface or at a mobile terminal. An algorithm, which does not allow unauthorized access as long as an authentication key is not known even if the algorithm information is disclosed, is desirable.
3) An algorithm, which both hardware and software can process very fast (faster than allowed for authentication), regardless of the way UIM is implemented (IC card or built-in type), is desirable. For hardware implementation low complexity is desirable. For software implementation small program size and small memory requirements are desirable.

2.3.1.2 Key Generation Algorithm

1) It is desirable to adopt an algorithm, which can generate highly secure random number sequences with a longest possible period, i.e. occurrence of the same key should be minimized.
2) An algorithm, which both hardware and software can process very fast (faster than allowed for key generation), regardless of the way UIM is implemented (IC card or built-in type), is desirable. For hardware implementation low complexity is desirable. For software implementation small program size and small memory requirements are desirable.

2.3.2 Re-authentication of Users

2.3.2.1 Authentication Algorithm

See 2.3.1.1.

2.3.2.2 Key Generation Algorithm

See 2.3.1.2.

2.3.3 Network Operator / Service Provider Authentication

2.3.3.1 Authentication Algorithm

See 2.3.1.1.

2.3.3.2 Key Generation Algorithm

See 2.3.1.2.

2.4 Confidentiality

2.4.1 User Data Confidentiality

2.4.1.1 Encryption Algorithm

1) It is required to standardize an algorithm, which can be commonly adopted all over the world, in order to realize international roaming (Key length and security against cryptanalysis should be also considered). In addition, it is desirable to standardize another algorithm with higher security.
2) An algorithm, which both hardware and software can process very fast (faster than allowed for encryption and decryption), is desirable. For hardware implementation low complexity is desirable. For software implementation small program size and small memory requirements are desirable.

2.4.1.2 Key Generation Algorithm

1) It is desirable to adopt an algorithm, which can generate highly secure random number strings with a longest possible period, i.e. occurrence of the same key should be minimized.
2) An algorithm, which both hardware and software can process very fast (faster than allowed for key generation), regardless of the way UIM is implemented (IC card or built-in type), is desirable. For hardware implementation low complexity is desirable. For software implementation small program size and small memory requirements are desirable.

2.4.2 Signalling Information Confidentiality

2.4.2.1 Encryption Algorithm

See 2.4.1.1.

2.4.2.2 Key Generation Algorithm

See 2.4.1.2.

2.5 Data Writing to UIM/MS

2.5.1 Scope of Standardization for Security Functionality

Table A8-3 Scope of Standardization for Security Functionality

Function	UIM form	Method to write	Mechanism	Algorithm	Key generation algorithm
UIM/MS authentication (UIM administrator to UIM/MS)	Removable	Writing device	X	X	X
		OTA	O/X (note1, 4)	O/X (note 4)	O/X (note 4)
	Non-removable	Writing device	O	O	O
		OTA	O	O	O
UIM administrator (note2) authentication (UIM/MS to UIM administrator)	Removable	Writing device	X	X	X
		OTA	O/X (note1, 4)	O/X (note 4)	O/X (note 4)
	Non-removable	Writing device	O	O	O
		OTA	O	O	O
Air interface confidentiality (ciphering with UIM data being initialized)	Removable	OTA	O/- (note 3)	O/- (note 3)	X/- (note 3)
	Non-removable		O	O	O
UIM-to-writing device confidentiality	Removable	Writing device	X	X	X
	Non-removable		O	O	O
UIM-to-UIM administrator (note 2) confidentiality	Removable	Writing device	X	X	X
		OTA	X	X	X
	Non-removable	Writing device	-	-	-
		OTA	O	O	O
Stored data confidentiality	Removable	Writing device/OTA	X	X	X
	Non-removable	Writing device /OTA	X	X	X

O: Standardization; X: Out of scope of standardization; -: Not applicable

Note 1: This is not subject to standardization if the air interface procedure is implemented with a standardized procedure, e.g. GSM SIM Application Toolkit (using user information of SMS (Short Message Services)). If it is a dedicated procedure, it is subject to standardization.

Note 2: UIM administrator means a UIM provider/administrator including a network operator/service provider.

Note 3: No confidentiality is necessary if security is maintained only with UIM-to-UIM administrator confidentiality. This is subject to standardization in other cases.

Note 4: It dose not preclude applying contents standardized for Non-removable UIM to Removable UIM.

2.5.2 Security Functionality

2.5.2.1 Authentication

1) UIM/MS authentication
   Functions to authorize writing-destination UIM/MS.
2) UIM administrator/writing device authentication
   Functions to prevent illegal data writing by using unauthorized writing device.

2.5.2.2 Confidentiality

1) Air interface confidentiality
   Written data and writing mechanism confidentiality
2) UIM/MS-to-writing device confidentiality
   Written data and writing mechanism confidentiality
3) UIM-to-UIM administrator confidentiality
   Written data and writing mechanism confidentiality on the channel between UIM and UIM administrator (End to End).
4) Stored data confidentiality
   Function of encrypting written data and storing in record media. Data disclosure and data forgery prevention by procedures except formal interface.

2.5.3 UIM/MS Data Writing Design Principle

Requirements for guaranteeing UIM/MS data writing security are:
- Strength for writing (making the mechanism, algorithm and key generation algorithm complex)
- Limiting the confidentiality scope (to be disclosed or standardized)
- UIM administrator proprietary procedure

Considering the above conditions, UIM/MS data writing design guideline shall be as follows:

2.5.3.1 Removable UIM

1) Data writing by writing device
   Each functionality must be at the discretion of UIM administrator.
2) Data writing by OTA
   The air interface confidentiality mechanism and algorithm should be specified. Other functionality must be at the discretion of UIM administrator.
   The functional requirement of the mechanism and algorithm is the same as that of confidentiality for call control.

2.5.3.2 Non-Removable UIM

1) Data writing by writing device
   It is required to standardize each functionality in order to realize a common procedure for data writing. In IMT-2000 system, it is required to disclose technical information to equipment manufactures (for MS/writing device) on global basis. Therefore a technology

and its operational method to guarantee security on these conditions must be studied. If the above technology and the operational method are hard to realize, it is required to consider a UIM administrator proprietary procedure for data writing to guarantee security.

2) Data writing by OTA
In addition to the similar questions in data writing by writing device, a technology and its operational method must be studied to prevent lower security level due to the radio interface use.

3. Necessity of Future Study

3.1 Security Management Area

- Management of 3G Mobile System specific security mechanisms and algorithms
  Update and control of the security mechanism and algorithm is for further study.
- Key management
  The authentication key generation algorithm and encryption key generation algorithm are specified.
- Encryption management
  The user data confidentiality and the signalling information confidentiality are specified. The user location confidentiality is not necessary for study if it is possible using the air interface confidentiality and a temporary ID.
- Authentication management
  The authentication algorithm is specified.
- Access control management
  The access control for subscription and service profile data is not subject to study.
- Service barring list management
  Not subject to study. It is regarded as access control for supplementary services.
- Security audit management
  For further study (It shall be studied when it is clearly defined.)
- Management of subscriber related credential information
  For further study (It shall be studied when it is clearly defined.)
- Information exchange regarding security management
  For further study (It shall be studied when it is clearly defined.)

3.2 Security and Private Services

- Transaction Security
  It is specified this time.
- End-to-end encryption
  Not subject to study if end-to-end means service provider to user.
  For further study if end-to-end means terminal to terminal.
- Password call acceptance
  Not subject to study.
- Subscriber PIN access & intercept
  Not subject to study.
- Procedure for the Change of Keyword (FWA)
  For further study (it shall be studied when it is clearly defined.)

- Signaling information element confidentiality
  It is specified this time.

4. Work Plan in Stage 2

In Stage 2, concrete security algorithms will be studied based on this design principle.
The study members mainly include security experts. However some mobile radio experts are required to join.
As the specification must be ready by April 1999, it is more realistic to start with existing mechanisms and to select algorithms from the existing ones instead of creating new ones for IMT-2000, because of the time constraint. However, taking into account the work progress and the status of technological development, the above policy is not necessarily mandatory.
Also, in terms of the data writing mechanism/algorithm for non-removable UIM in chapter 2.5.3 "UIM/MS data writing design guideline", it is difficult to quickly select a technology and its operational method in which security against cryptanalysis is possible in the case that the technical information of UIM data writing is disclosed to equipment manufacturers on global basis. Therefore, it is desirable to study all security functions, excluding OTA, based on removable UIM in Phase 1.
However, taking into account that the both of removable and non-removable UIMs are under study for the ANSI evolution since compatibility with the 2nd generation is strongly required, it is required to specify standards for the subscriber data writing. Measures to realize it using OTASP (Over-the-Air Service Provisioning), ROM writer and so forth, are seen. It is required to develop and standardize a technology and its operational method by taking much care of preserving security when the writing technology is disclosed to equipment manufacturers. Since the content of the subscribe data writing standard is limited and the subscriber data writing standard includes confidential matters even in the process of documentation, it shall be documented in a separate volume. It shall be able to disclose the main volume so that range of disclosure can be limited because of the same reason above, by separating it into ANSI evolution and GSM evolution parts.
As a summary, Table A8-4 shows functions to be standardized for the ANSI and GSM evolutions.

Table A8-4 Functions to be standardized in Phase 1 for the ANSI and GSM evolutions

Item no.	Item	Mechanism		Algorithm		Key generation algorithm	
		ANSI	GSM	ANSI	GSM	ANSI	GSM
1	User Identity Authentication	O	O	O	O	O	X
2	Re-authentication of Users	O	O	O	X	O	X
3	Network Operator / Service Provider Authentication	O	X	O	X	O	X
4	User Data Confidentiality	O	O	O	O	O	X
5	Signalling Information Confidentiality	O	O	O	O	O	X
6	User Identity Confidentiality (temporary ID)	O	O	X	X	X	X
7	User Location Confidentiality	O	O	X	X	X	X

8	Access Control for Subscription and Service Profile Data		X	X	X	X	X	X
9	Version Control of Security Data and Mechanisms		O	O	X	X	X	X
10	Writing subscriber data to UIM	Removable	X	X	X	X	X	X
		Non-Removable	O(note)	-	O(note)	-	O(note)	-
11	Emergency Call		O	O	O	O	O	O

(Note): This item requires considerations for confidentiality.

Appendix 1

Consideration on Implementation of Location Services

Table of Contents

1. Introduction.

From the view point that characterizes a 3G Mobile System as providing services with a higher quality than in 2G Systems, it is expected that 3G Mobile Systems provide new wireless mobile-specific services such as a high quality location service. It is also expected that the accuracy of such a location service can be made higher than in 2G systems. The main reasons for this is the high chip-rate that provides an inherent high resolution for time-based measurements, and the fact that there are no backwards-compatibility constraints in the radio access network part, including no previously existing mobile stations.

Applications using the location service are categorized into several types with different requirements on accuracy, reliability, security and so on. Some examples of such applications are emergency call positioning, fleet dispatch business, guidance of city-sightseeing and so on.

One positioning-based application that requires a high accuracy and reliability is positioning of emergency calls. Although positioning of emergency calls can easily be done through the subscriber-number for fixed-line calls, it is not as easy for mobile calls, for obvious reasons. Since authorities are the users of this application, there may be regional or national requirements to provide a location service in mobile cellular systems, for the sole purpose of positioning emergency calls.

The future 3G Mobile System should provide a location service with high accuracy, reliability and security.

To do this, it is highly important to consider the basic items for the support of a high-quality location service already from the beginning of the standardization process. If this is not done, it may be difficult to make changes in the functional entities and interfaces at a later stage.

2 Types of Location Applications

There are many applications that could utilize subscriber location service. One obvious example is the location of emergency calls, but there are many more. Some examples of applications based on location services are listed below.

Emergency service: Emergency service would identify the user's location to the appropriate service organization sending assistance.

Location based information service: Area information around the user's location, such as restaurant, sightseeing, hospital, pharmacy, weather forecast information, etc. The registered user can finish his check-in automatically when he enter the airport area.

Location sensitive billing: There may be an interest from operators, to base the charging on the geographic location of the subscriber. For instance, allowing cheaper calls from the subscribers residence.

Fleet management: Fleet management can be used by a transportation company to keep track of where each vehicle of the fleet is currently located.

"Where are you" applications: Keeping track of e.g. child, elderly, disabled person, employee, etc.

Tracking of valuable assets: Supervision of high security transports. This could be transportation between banks etc. This application could also be used to track down stolen terminals or any object that has a terminal attached to it, e.g. stolen cars.

Navigation: Indication of current position, navigation to the destination.

Real time traffic update: Offering a traffic information around his position such as traffic jam, road construction, accident, etc.

Location statistics for network planning: A way for operators to collect statistics about the usage of their network. This information could be used for improvements and tuning of the network, e.g. whether to add micro cells.

Location statistics for dynamic network control: Similar as above with the difference that there might be parameters in the network that could be tuned in real time to improve the performance of the system.

N.B.: This listing is neither exhaustive, nor systematized. The name of service is not exclusive.

Each location service will put certain accuracy requirements. In the figure AP1-1, some possible applications are listed together with their expected accuracy requirements.

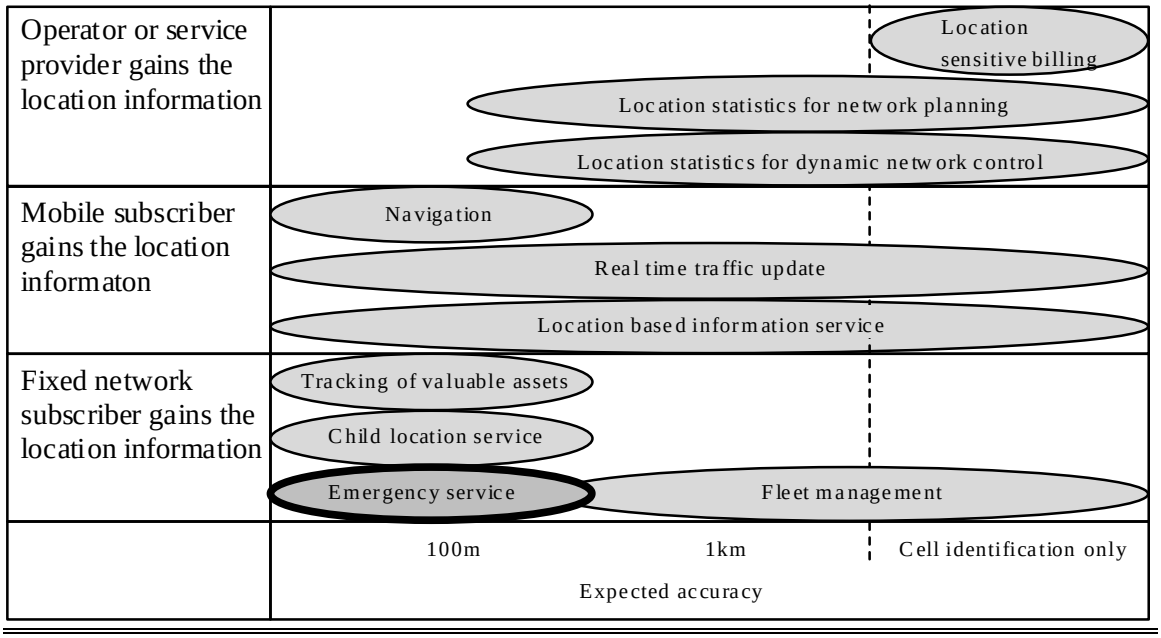


Fig. AP1-1 Accuracy Image of Location Services

3. Image of Location Services

3.1 Modularity Image of Location System

Figure AP1-2 shows general system configuration. It is considered that the location System consists of two major part, Positioning Measurement System and Location Services Access Point (LSAP). Both system obtain necessary information for location service, e.g. location data of mobile terminal, through a 3G Mobile System network.

It is considered that the location system can support the location service by these functional module which is implemented into a 3G Mobile System independently.

Positioning Measurement System : This system has a function to identify the location of mobile terminal by adopting applicable measurement method, for example, Angle of Arrival (AOA), Time of Arrival (TOA), Time Difference of Arrival (TDOA) or using third parties' positioning system such as GPS (Global Positioning System). In some case, combination of these method may be adopted.

Location Services Access Point (LSAP) : It is an access point which provide the location data, e.g. location of the terminal and terminal ID information obtained by the above Positioning Measurement System, to a location service provider or legal authorized party.

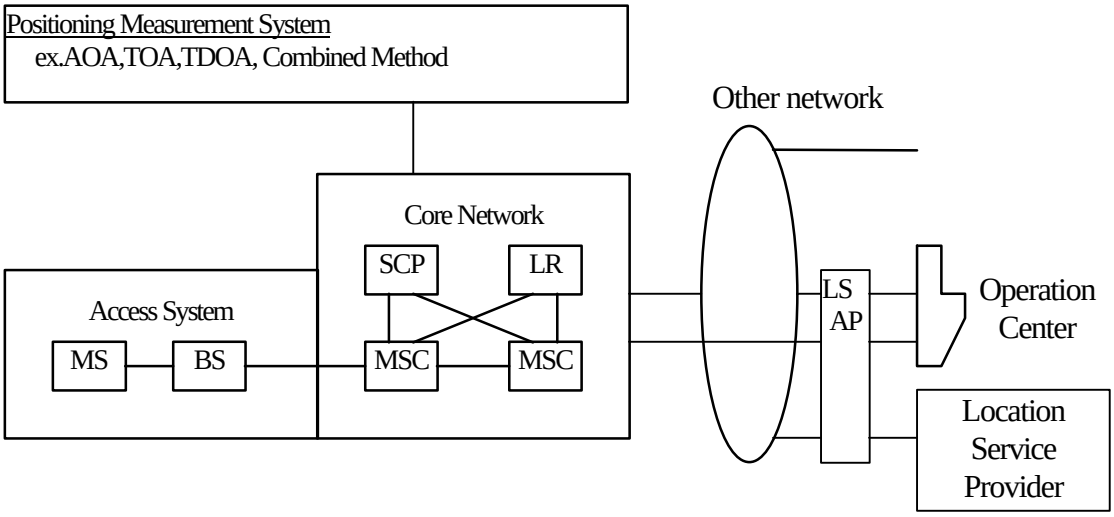


Fig. AP1-2 Modularity Image of Location Services

3.2 Image of Mobile Positioning Network

The Mobile Positioning System's role is to determine the location of wireless stations within the coverage area, maintain a database of this information for the subscriber, and provide the location data to location service applications through an open interface.

Image of Network Model

As an example, figure AP1-3 below presents a Mobile Positioning architecture for the creation of location based services as one of examples. The presented network interface model utilizes the Wireless Intelligent Network model to introduce the Mobile Positioning System. The diagram shows the mobile positioning functional entities and an example mapping to physical network elements. Other mappings can also exist.

In this Figure, the new functional entities are shaded in the darker gray. The light gray represent a new mobile positioning network element for which the function could reside.
Each of the new functional entities, new network entities are described below :

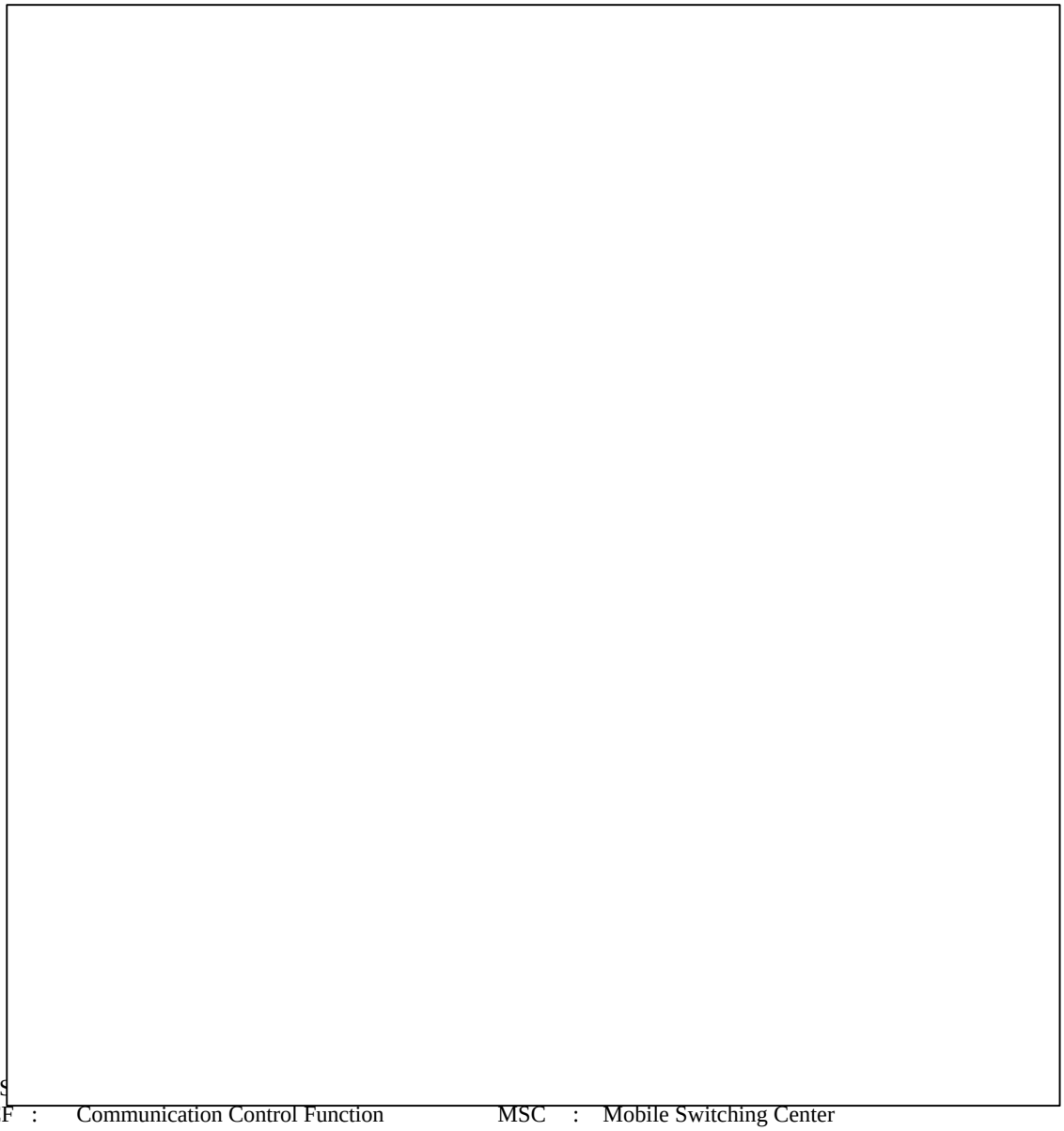
New Functional (Network) Entities

Location Determination Function
The function of the Wireless IN (WIN) Distributed Functional Model that is responsible for the collection and the reporting of the geographical location of the Radio Terminal Function.

Location Determination Technology
A hardware and/or software component in the network, in the handset or in some combination of the two that collects and reports position related data of a subscriber. There are many options for Location Determination Technology and it is considered beyond the scope of this annex.

Mobile Position Function
The function in the WIN distributed functional model that is responsible for aggregating position data from the Location Determination Function, maintaining a database of current locations of RTFs, and making the location information available to the Service Control Function.

Mobile Position Register
A network element that performs the Mobile Position Function in the WIN Distributed Functional Model. The MPR may or may not be located within, and be indistinguishable from the VLR or MSC.



BSS

CCF	:	Communication Control Function	MSC	:	Mobile Switching Center
HLR	:	Home Location Register	RRC	:	Radio Resource Control
LDF	:	Location Determination Function	RFTR	:	Radio Frequency Transmission and Reception
LDT	:	Location Determination Technology	SCF	:	Service Control Function
LRCF	:	Location Registration Control Function	SCP	:	Service Control Point
MPF	:	Mobile Position Function	SSF	:	Service Switching Function
MPR	:	Mobile Position Register			

4. Position Measuring Methods

Various Positioning methods for Location Service are Summarised in Appendix 1-1 from survey of position estimation methods.

Appendix 1-1 shows positioning methods by horizontal axis and those principles, observation configuration, source observation information, accuracy of information, observation error, required observation time, also merits, difficulties, application examples, applicable environments etc. by vertical axis.

Typical positioning methods are:

(1). AOA (Angle of Arrival)
(2). TOA (Time of Arrival)
(3). TDOA (Time Difference of Arrival)
(4). Distributed Receiving System (Monitoring Post)
(5). Distributed Transmission System (Sign Post)
(6). Combined Location Techniques

AOA measures angle of arrival of incident radio wave by using directive beam antennas or non-directive antenna array with array signal processing in Base Station or Mobile Station.

TOA measures propagation delay of radio wave, and TDOA uses time differences of propagation delay to multiple Base Stations as in the case of Hyperbolic Navigation System.

Monitoring Post uses Location Registration Information of handsets via each Visitor Base Station's service area, and Sign Post is such a method as mobile terminals acquire those own position information from deployed multiple transmitting stations.

Combined Location Techniques utilise multiple positioning methods such as combination of both AOA and TOA.

Many development projects related to positioning systems are proceeding worldwide specially in such area as Array Signal Processing and Software Radio, so selection of practical method should be subject to further study.

5. Objectives and Requirements of Location Services

5.1 Objectives of Positioning Measurement Accuracy.

The state of the art technologies should be introduced into positioning measurements location services as possible, because there is great demand for this field of services, so the technologies in this field is improving so fast in near further. One of most accurate positioning measurements required should be the case to identify a calling mobile station under the circumstance of emergency. A 3G Mobile System should be designed as objective to identify the location of a Mobile Station within a radius of no more than 125 meters in 67 percent of all cases. The degree of an accuracy will be calculated through use of Root Mean Square methodology.

This should be applicable to Emergency Services.
Note1- The locating accuracy follow to the FCC's Report and Order, CC Docket No.94-102.

5.2 Position Measuring Algorithm

The position measuring algorithm such as AOA, TOA, TDOA, etc. are not required to be standardized uniquely at this time, because improvements of technologies in this field are rapidly achieved to realize accurate positioning measurements and much higher quality of location services in future. The standardization at this time will limit any applications of future technologies improvements.

5.3 Requirements on Air Interfaces

A 3G Mobile System has a unique opportunity to standardize superior location services because wideband systems such as Wideband CDMA has a sufficient inherent accuracy of around 0.1?s for time-based measurements superior to those of 2G Systems. If this opportunity is not taken, this could become a significant disadvantage for such systems.

An issue to be considered is the problem of non line of sight which is common to all mobile cellular communication. Another major issue in a CDMA system is the near-far problem, i.e. for MS to "hear" neighboring BTS when close to its active BTS. This is also referred to as hearability.

The following is the non-exhaustive list of requirement topics for further study:

- Solution for the non-line-of-sight problem
- Solution for the hearability, for example, MS transmission radio power control, i.e. MS should be equipped to select and use the channel with the strongest cellular signal whenever an emergency call is to be placed.
- Time-based measurement requirements

5.4 Requirements on Network.

In order to support the requirements of these location services, the addition of new location network functions and network entities will be required. New and modified interfaces to the existing wireless network will also be required.

The necessary signaling should be studied for services user such as FCC enhanced 911 emergency rule-making (FCC's Report and Order, CC Docket No.94-102), e.g. cell ID (currently used in spite of more Accurate location information in future), calling MS ID, call back function, tracking of calling MS, accept roaming MS, MS without authentication. The use of MS for making emergency call to the police without a valued UIM should be studied.

5.5 Requirements on Service Access Points.

In order to support various location services and allow to provide those services by services provider, it is required to specify the related interface reference point and general data format of coordinates. To protect a user privacy against illegal user, applicable authentication and encryption scheme should be adopted at inter-system exchange of those location data.

In addition, the external service provider may prefer to access and communicate with the MS via Internet. To support it, regarding to the interface and data protocol related to the location service, it is expected to consider a compatibility and interworking with TCP/IP.

5.6 Security.

In order to protect the privacy of a 3G Mobile System user, access to location information must be restricted to specific applications authorized by the 3G Mobile System user and the administration concerned.

5.7 Reliability

Wireless Location Services are based on the measurements of radio wave propagation phenomena, it is well known that there are some limits of performance as much as other wireless services, because there may be some cases that radio waves may not received someplace due to poor radio propagation environments.

But especially from the view point of the wireless emergency service, It is very important for the concerned operators and organizations to make an effort usually to improve the service quality as one of public safety services.

6. Conclusion

Location service in a 3G Mobile System is one of characteristic aspect to be provided as mobile specific services like new generation of mobile telecommunication system, because 3G Mobile System users should require more safety and use location information as natural atmosphere.

Technological aspect of location serves shall be rapidly improved so that positioning measurement algorithm should be left to many competitors to realize accurate positioning.

But standardized issue of Air-Interface and Network-interface should be prepared for better location services from the beginning of a 3G Mobile System development to accelerate technological improvement from the view point of Characteristic that a 3G Mobile System shall bring us more cultural world.

Emergency services are most prior matters to be standardized from the beginning of standardization process, and that the most important public services inevitable to be taken into the consideration of standards. It must be also required some kind of regulatory issues such as a prohibition of calling and that an emergency calling MS may select and use the channel with the strongest cellular signal whenever a emergency call is placed like FCC rule-making.

Finally, this version of requirements should be improved stage by stage in standardization of a 3G Mobile System in future and a 3G Mobile System is wished to be succeeded as social wireless telecommunication infrastructure.

7. References

(1) FCC/CC Docket No. 94- 102, June 12, 1996.

Appendix 1-1: Location Estimation Techniques

Method	AOA (Angle of Arrival)	TOA (Time of Arrival)	TDOA (Time Difference of Arrival)	Distributed Receiving Monitoring Post	Distributed Transmission Sign Post	Combined Location Techniques
Principle	Draw a base line from incidence angle of arriving wave to the target position. Determine the target position in two dimensions (x,y) from intersection of two base line vectors.	Measure the propagation time of the wave and calculate distance (d_i) between transmitter and receiver. The intersection of circumferences of circle c_1 and c_2 which centered at known points and radiuses are d_1 and d_2 will be the target position in two dimensions.	Obtain receiving time difference by measuring each receiving time of synchronized signals which are transmitted from plural transmitters. Locuses of which positions have same receiving time difference value of synchronizing signals from two transmitters will be hyperbolic curves which focuses are on two transmission position. Describe two hyperbolic curves of the same receiving time difference. The intersection will be the target position in two dimensions.	Monitoring Post Receiving - Measure the receiving signal strength (RSS) of reverse link at monitoring post. Determine the position by relation of receiving strength and post position. (electric field/signal measurement, receiving area positioning)	Sign Post Transmission - Measure receiving signal strength (RSS) of forward link. Determine the position by relation of receiving strength and post position. (electric field/signal measurement, receiving area positioning)	(Combination of each method) Example; AOA + TOA Determine the position (x, y) on a single base line from base line to the target position which is obtained from incidence angle of arriving wave and distance (d) to the target position which is calculated by propagation time.
Observation structure	Measure the incidence angle of arriving wave at least two base stations (or, at a terminal, measure incidence angles at least from two base stations). Array antenna required.	Measure the plural numbers of (at least two) propagation time of receiving signals at terminal or base station. In the case that clock of high accuracy is equipped in the base station and the terminal, inter-BS synchronization is not required.	Measure the plural numbers of (at least three) arrival time difference of forward signals from base station. Inter-BS synchronization is required since forward signal shall be synchronized.	Measure receiving signal strength (RSS) of reverse link at monitoring post. The functions of RSS measurement and terminal identification are required in each post. Inter-BS synchronization is not required.	Each sign post transmits unique identification code. The terminal measure it and report the result to the base station. Inter-BS synchronization is not required.	(Combination of each method described in the left columns) Example; AOA + TOA Measure the incidence angle of arriving wave and propagation time at single base station or terminal. Array antenna and clock is required.
Information to be observed	Incidence angle of receiving wave	Propagation time of receiving wave	Arriving time of waves which were emitted in a same time	Receiving signal strength (RSS) of reverse link at monitoring post	Receiving signal strength (RSS) of forward link at terminal	(Combination of each method described in the left columns) Example; AOA + TOA incidence angle of arriving wave and propagation time of the wave
Accuracy of information	- In the case of the direct wave, the incidence angle of receiving wave indicates almost correct direction because refractive index in the atmosphere is 1.0003. - In the case that mixture propagation path of land and ocean, i.e., coast line etc., is included, coast line error is generated. When the angle (α) of coast line and direction of wave is	- Coherent detection is possible by autocorrelation characteristics of PN sequence in a time of 1/x of Tc. If chip rate is 4.096 Mcps, Tc is about 244 ns and timing detection is possible in every 50 ns. - In the case of direct wave which generates EPD (Extended Path Delay) in propagation path, propagation delay by atmosphere,	- About fluctuation of EPD in propagation path, same as TOA in the left column.	- In the case determine it by the post which have maximum strength of receiving electric field, it is limited in area judgment which indicated by the radius which is covered by each post.	- Same as the Distributed Receiving Monitoring Post in the left column.	Combination of accuracy shown in the left columns. There is a case, by the combination, that the error is reduced or countervailed. Example; AOA + TOA Combination of accuracy of information of AOA and TOA in the left columns.

	10 degrees, the refraction of about 2.2 degrees is generated on the intersection with coast line.	in 3 km of propagation path length, is about 3~4 ns by dry atmospheric pressure and about 1 ns by steam pressure. The propagation delay fluctuates by atmospheric pressure and saturated steam pressure. In the case of Multipath, when reflected wave/diffracted wave passed through it, the delay by reflection/diffraction is included. Refer to annex-1 on the amount of delay.				

Method	AOA (Angle of Arrival)	TOA (Time of Arrival)	TDOA (Time Difference of Arrival)	Distributed Receiving Monitoring Post	Distributed Transmission Sign Post	Combined Location Techniques
Measurement error	Depends on the bearing error of array antenna	Depends on the frequency stability of reference oscillator of both transmitter and receiver.	Same as the left column	Depends on the measurement error of receiving signal strength	Depends on the measurement error of receiving signal strength	Combination of those errors shown in the left columns. There is a case, by the combination, that the error is reduced or countervailed. Example; AOA + TOA Addition of AOA and TOA in the left columns.
Required time period of measurement	Depends on the ability of array antenna. However, since it is judged by electromotive force generates in antenna element which is driven by arriving wave, it is expected that observation on signal of several phases is required.	In the case of terminal measurement (and on WB-CDMA), coherent detection is required by averaging correlation output of forward link signals for several code cycles and detect the maximum correlation output.	Same as the left column	It is desirable to conduct the measurement in every several seconds to obtain the median restraining the effect of fading.	It is desirable to conduct the measurement in every several seconds to obtain the median restraining the effect of fading.	The greatest common divisor of time which is necessary for each of combined methods.
Requirements for observation	Observation by plural numbers of station (at least two stations) is mandatory.	Observation by plural numbers of station (at least two stations) is mandatory.	Observation by plural numbers of station (at least three stations) is mandatory.	Measurement by single station is acceptable in the case that arrangement of monitoring post is closed.	Measurement by single station is acceptable in case that arrangement of sign post is closed.	By the combination, measurement by single station is acceptable. (Example; AOA + TOA)
Observation Instruments	- array antenna which measures incidence angle - CPU to analyze base line basing on the data which observed in each station	- Clock to measure propagation time. In the case of SS, it is possible to use existing receiving unit (synchronization circuit). - CPU to analyze base line.	- Clock to measure (judge) arrival time of wave. In the case of SS, it is possible to use existing receiving unit (synchronization circuit). - CPU to analyze hyperbola.	- RSS measurement circuit (included in the existing receiver)	- RSS measurement circuit (included in the existing receiver)	Instrument which is needed for each of combined method.
Advantages						
1) measurement instrument	No special equipment is needed to add to terminal when conduct measurement at base station.	No additional equipment is needed to antenna system both in base station and terminal.	No additional equipment is needed to antenna system both in base station and terminal.	No special equipment is needed to add to terminal.	No special equipment is needed to add to terminal.	(Depends on the combination)
2) radio system	Available without depending on radio system.	In the case of DS-SS, receiving time detection with high accuracy is possible.	In the case of DS-SS, receiving time detection with high accuracy is possible.	Available without depending on radio system.	Available without depending on radio system.	Available without depending on radio system. (depends on the combination)
3) restriction in synchronization	Reference clock with high accuracy is not required. (synchronization of base stations is also not required.)	If transmitting side can keep synchronization of stations with high accuracy, restriction of time accuracy in receiver side is not strict. (because it is possible to eliminate time error according to	Since arrival time difference is necessary information, this error does not effect to estimation of hyperbola if the error of arrival time measurement is constant. Therefore, restriction of time	Reference clock with high accuracy is not required. (synchronization of base stations is also not required.)	Reference clock with high accuracy is not required. (synchronization of base stations is also not required.)	Reference clock with high accuracy is not required. (depends on the combination)

		measurement results)	accuracy in receiver side is not strict.			
4) Others	In the condition to use TOA/TDOA etc. in the same time, measurement by single station is possible.		Locus equation of hyperbola of arrival time deference of wave which is obtained by combination of base stations is easy to conduct estimation treatment since it is possible to keep it as a data in advance in base station side.	(a) If the post arrangement is closed, complicating measurement calculation is not required. (b) If arrangement of base station is very closed (pico-cell structure), the common base station can work as function of monitoring post.	Same as Receiving Dispersion Monitoring Post in the left column	Measurement by single station is possible. (depends on the combination) It is possible to clear hearability problem . (depends on the combination) It is possible to solve hearability problem caused by Power Con. (can not be received in some stations).

Method	AOA (Angle of Arrival)	TOA (Time of Arrival)	TDOA (Time Difference of Arrival)	Distributed Receiving Monitoring Post	Distributed Transmission Sign Post	Combined Location Techniques
Weak point	Array antenna is required for location estimation.	(1) In the case to follow the same system as GPS, inter-BS synchronization with high accuracy is required. (2) Location determination can not be done by single station.	(1) Inter-office synchronization with high accuracy is mandatory in the case of hyperbola method. (2) Location determination can not be done by signals from two stations.	(1) To improve the accuracy, a lot of posts are required. (2) Countermeasure for over reach is needed.	To improve the accuracy, a lot of posts are required.	Study on the most suitable combination of systems is needed.
Calculation	The direction of base line vector is provided by incidence angle θ and it is obtained by answering simultaneous simple equation which has two variables. $f(n) = O(n)$	Answer to simultaneous simple linear equation which has three variables.	The calculation order f(n) equal to $O(n^2)$. Because it calculates the intersection of family of confocal central conics which has parameter λ. (If hyperbolic function F(x,y) are calculated in advance, the above equation can be solved by liner order.)	Only comparison of receiving data	Only comparison of receiving data	(Combination of systems in left columns)
Example of application	Phased array radar	Positioning system using satellite (GPS, GLONASS)	Positioning system for ship (LORAN, Decca, Omega)	Location service in PHS		Radar
Suitable Environment	- Rural and the area where is easy to ensure LOS (Satellite etc.).	- Urban and Sub-urban where observation by plural stations is easily available.	- Urban and Sub-urban where observation by plural stations is easily available.	- Urban and Indoor environment which are in Pico-cell structure.	- Urban and Indoor environment which are in Pico-cell structure.	(Depends on the combination) Example; AOA + TOA Rural environment where error measurement between AOA and TOA (in the left columns) by plural stations is difficult.

Appendix 1-2
A study example on accuracy of measured distance.

1. Assumed combination method of TOA and AOA

1.1 Measuring principle

(1) To measure the position of MS in the cell by several neighboring Base Stations.

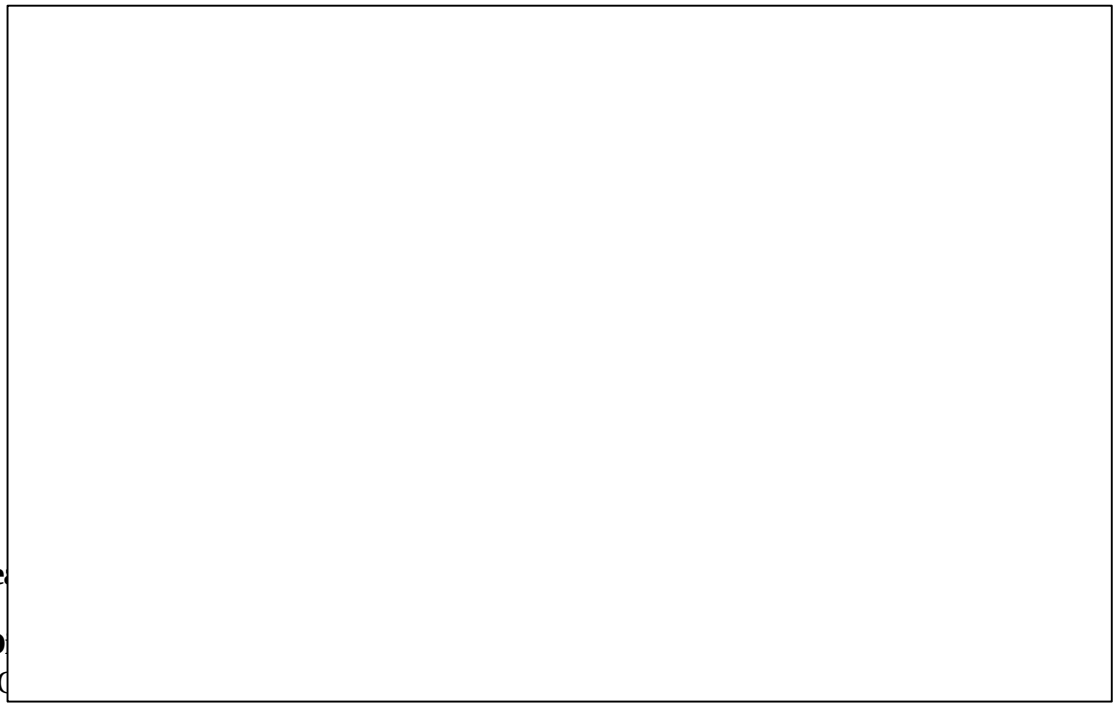
(2) Measurement by utilizing information on the distance from the Base Station and information on the bearing.

(2-1) Distance information is acquired by means of a measuring algorithm named by TOA (Time Of Arrival) on the clock basis of the Base Station timing generator.

(2-2) Bearing information is acquired by means of a measuring algorithm named by AOA (Angle Of Arrival) from incoming radio wave.

1.2 Image diagram.

Image diagram is showed fig. AP1-4, a typical cell size is supposed to have a radius of 5km in this case.



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ambiguity in the cell radius of approximately 5km (16.5μSec) is simultaneously used.)

1.3.2 Bearing accuracy

When $\Delta\theta = 1°$ is estimated value, $(2\pi \times 5{,}000\text{m}) / 360° = 87$ m (It is necessary to conduct decomposition processing for direct waves and multi-path-propagation waves.)

1.3.4 measured error of MS and BS

In CDMA system, a MS transmits its own frame with adjustment to the initial top of the frame from a Bs, and the BS has to measure the frame from the MS by the accuracy of 1/4 chip (0.25chips) or less and perform chip synchronization.

Namely, both of MS and BS possess the measuring capability on TOA by way of using short

code and long code respectively.
Consequently, if we can specify

(1) BS chip synchronization accuracy = 0.25 chips.
MS chip synchronization accuracy = 0.25 chips.
Or
(2) (BS+MS) chip synchronization accuracy = 0.5 chips
(Allocation between BS and MS is determined separately),

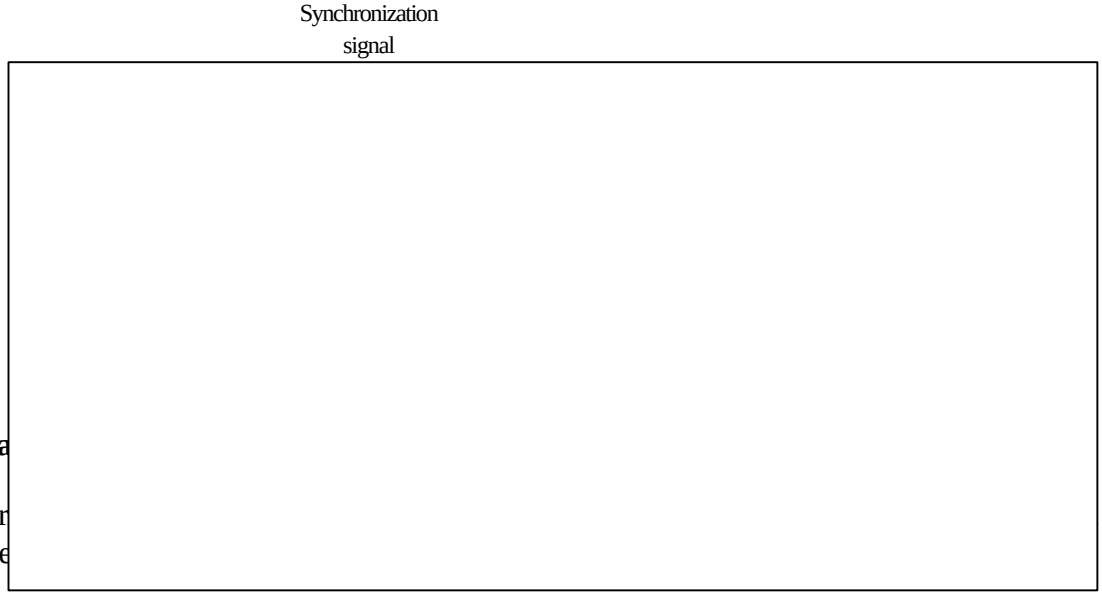
then

Measurement accuracy by TOA = 76m + 38m = 114m is less than 125m which is specified in FCC docket.

From the mentioned above, it is considered that the required positioning measurement accuracy may be satisfied with under the condition of taking no account of the other fluctuation.

1.4 Method (Study Example)

(1) A mobile equipment returns the answer signal to a Base Station after a timing of delta-t from the synchronization signal by the Base Station.
The mobile equipment measures time delta-t by the regenerative clock of the down-stream signal. (Needless to say, an error may occur in this occasion by fluctuation of clock recovery and jitter etc)
(2) Propagation delay in this occasion is assumed as shown in Figure bellow.
(3) Position information data which can be measured by the Base Station:
Bearing angle , wave angle , $\Delta\tau 1$, $\Delta\tau 2$.
(4) A result of computation by longitude, latitude, and altitude is suitable for the position information. (Map data, Car navigation data).
(5) There is a possibility to improve the accuracy when multiple Base Stations can conduct the measurement. The position can be estimated by means of a center function located at somewhere in the positioning system.



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CDMA Receiver Units : It is needed one set of the (About 8ch.) Receiver plus demodulator.

Signal Processing Unit is a set of sub-equipment installed such as a TOA and an AOA

decomposition processing unit plus data transfer interface.

Appendix 1-3:

Emergency Service

After the investigation of Emergency Service, we found the following requirements issued by FCC.

1. Enhanced 911 (E911) Service Requirements on FCC Rule

1.1 Background

In the United States, dealing 911 is the most effective and familiar way to contact the police and fire department in an emergency, and that is provided by local exchange carriers (LECs). In 911 service, the emergency calls are connected at first to Public Safety Answering Points (PASPs) and then, passed the information to the public emergency facilities.

Since it is introduced in 1968, 911 service has spread across the Nation, now 95 million 911 calls are made each year, or 260,000 every day.

Over the last decade, most 911 systems and PSAPs have been upgraded to enhanced 911 (E911), which adds features that permit more efficient and speedy response by emergency service personnel, for example, passing the caller's telephone number and other useful information based on LEC records. Currently, 89 percent of wireline phones in the United States are served by 911, and about 85 percent of 911 services include some form of E911.

The remarkable point is, in 1994, almost 18 million calls (20% of all 911 calls) were made by the wireless phone. It coincides with the facts that 62 percent of cellular users cited safety and security as their main reason for purchasing a mobile phone. In other words, wireless phone is major part of 911 services in the United States, and in the future, the number of calling 911 from wireless phone is growing rapidly, spurred by the rapid growth in cellular and Personal Communications Service (PCS) subscribers.

In wireless phone, however, the calling location is normally not fixed, particularly at night, the calling person is often not familiar with the reporting point, therefore the location information is the key issue to save lives and property.

From the public point of view, in United States, E911 services is necessary to be provided to wireless phone as same level of wireline phone, the identifying location is the most important issue in this service.

2. The Requirement on FCC Document

2.1 The Accuracy of measuring the calling position.

Under phase II, covered carriers are required to achieve the capability to identity the latitude and longitude of a mobile unit making a 911 call, with a radius of no more than 125 meters in 67 percent of all E911 emergency calls.(effective from October 1st, 2001)

2.2 Main System Requirement

(1) In emergency case, covered carrier must process and transmit to any appropriate PSAPs all 911 calls made from wireless mobile unit even those calls initiated by roaming MS or MS without authentication.

(2) At the same time, the information of a caller's Automatic Number Identification (ANI) and the location of the base station or cell site, is relayed to the designated PSAP. (Phase I)

(3) The function of call-back and tracking is required.

(4) E911 calling process and the transfer connecting have the higher priority.

In the conclusion, due to the fact that the emergency service requests the high accuracy of the location measurement, it is considered a big impact for 3G Mobile Services network function and system design.

Appendix 2

Discussion Paper for Set of Radio Bearer Channels

1. Background

In its report to the 4th Systems Working Group meeting on 27th March (Doc. ISWG4-4 refers), Air Interface Working Group requested to Systems Working Group to identify a set of radio bearer channels to be provided in a 3G Mobile System for their eventual efforts to optimize the channel design. The meeting gave guidance that the issue should be discussed among relevant Working Groups, in particular Applications Group and Air Interface Working Group, which has not yet made progress.

The similar question has been raised in the Working Group of the Next Generation Mobile Communications Systems Sub-committee of the MPT's Telecommunications Technical Council, though it was pointed out that the terminology, radio bearer channel might be inappropriate and confusing. The Working Group has also not been able to resolve the issue yet.

2. Proposed Actions by Drafting Group

In order for this issue to make a progress, the Chairman of Drafting Group considers it necessary for the members of Application Group to develop a discussion on a minimum set of radio bearer channels. The minimum set of radio bearer channels is a set which is required to be as a minimum provided in a reasonably optimal way and which should be recognized as the guidelines by the radio transmission system designers.

3. Discussions

(i) The third generation system should be compatible with the service requirements for the ISDN era, leading to the minimum requirements for the user data rates to include 64kbit/s, 128kbit/s (2x64kbit/s), 384kbit/s (6x64kbit/s) and 1,536kbit/s (24x64kbit/s). In order for the system to be used for FWA applications, it will also need to support 144kbit/s (2B+D, ISDN BRI) and 1,544kbit/s (23B+H, ISDN PRI). It should be noted that these channels requires primarily 10E-6 BER and may also need 10E-4 BER for some applications of video coding. Any overhead to support such channel performance need to be counted on top of the numbers.

(ii) For selecting the user rate less than 64kbit/s for data service, it should assume a specific rate adaptation mechanism referred in ISDN recommendations(ref.TABLE 4-6/Q.931) to keep consistency of communication service among ISDN and 3G network. .

(iii) Even in the third generation era, voice band data applications cannot be ignored, where both maximum and minimum data rate will move to the higher side. The modem modulation data rates of 2.4kbit/s, 4.8kbit/s, 9.6kbit/s, 14.4kbit/s, 28.8kbit/s, 33.6kbit/s and 56kbit/s are currently used. Although the serial port data rates of 2.4kbit/s, 4.8kbit/s, 9.6kbit/s, 19.2kbit/s, 38.4kbit/s 57.6kbit/s and 115kbit/s are used

for the serial interface between PC and a modem, the data over the serial port are often compressed by means of, e.g. MNP, to match with the lower modem modulation data rates . Considering direct connection between two mobile terminals, serial interface data rates are dependant in place of modem output data rates. Furthermore, serial interface data rates are replaceable to other bearer rates such as 16kbit/s, 32kbit/s and 64kbit/s by adopting the RS/CS data-flow control scheme. It should be noted that these channels require 10E-6 and 10E-4 for some applications. It should also be reminded that any overhead which support above channel performance need to be counted on top of those bearer rates. Some of voice band data modems implement an in-band data rate negotiation mechanism such as MNP which may require additional bits over the radio bearer channel depending on the design of IWF for voice band data services.

(iv) The telephony service may adopt multiple speech codecs with different coding rates while they will contain their internal error combating mechanism resulting in the BER requirements of 10E-3 range for the radio bearer channels. The coding rates including any overhead have yet to known, they will be in the range of 8kbit/s, 12kbit/s and 16kbit/s.

(v) In the telephony service, the one-way speech delay within a 3G Mobile System network should not be greater than 80ms for a design objective, including the speech codec delay which is no greater than 45ms, according to the report from the Application Group for the speech delay issued at the end 1997of and Section 6.2.2.3 of Volume1.

(vi) The minimum set of radio bearer channels can be given in the form of the circuit switched mode. It is suggested to design radio channels to support in a reasonably optimal manner the minimum set for provision of circuit switched services. The packet switched service can be implemented using the mimimum set of radio channels and by adding packet specific procedures. It should be noted that the packet mode transmission uses Layer 2 retransmission scheme, which means that the BER requirement for Layer 1 of the channel may be less stringent than that quoted for circuit switched services. Since W-CDMA Layer 1 interface will be flexible in setting the BER performance at the discretion of operators, no specific BER requirements for Layer 1 would be needed for the packet mode services.

1. Recommended Minimum Set of Radio Bearer Channels

Based on the discussion in section 3 above, the following set of radio bearer channels could be minimum requirements for a 3G Mobile System. It shall be noted that the minimum set does not intend to preclude for the radio transmission system designers to implement any other types of bearer channels now and in the future. Any additional radio bearer channels could be added in the specification later, and the radio interface should be flexible enough to include the additional bearer channels.

It shall also be noted that an asymmetric assignment of bearer channels to the forward and reverse links be implemented.

Note that all bit rate numbers are net numbers for the users' perspective and do not include any overhead to support the required channel performance except for the telephony services. Also note that bit error rates worse than those indicated below might be usable for certain applications.

At the moment the delay values are left for further study, since the requirements seem to depend on the.

As mentioned in the discussion part above, no specific channels for the packet mode services are specified below.

For telephony speech services

Bit rate	BER	Delay	
8kbit/s	10E-3	???	(number may be adjusted as codec study develops)
12kbit/s	10E-3	???	(number may be adjusted as codec study develops)
16kbit/s	10E-3	???	(number may be adjusted as codec study develops)

For data applications

Bit rate	BER	Delay	
9.6kbit/s	10E-6	???	(10E-4 for some applications)
16kbit/s	10E-6	???	(10E-4 for some applications)
33.6kbit/s	10E-6	???	(10E-4 for some applications)

Note: Bit rates at 8 and 32 kbit/s may be needed for the ISDN subrates transmission.

64kbit/s	10E-6	???	(10E-4 for some applications)
128kbit/s	10E-6	???	
144kbit/s	10E-6	???	
384kbit/s	10E-6	???	
1,536kbit/s	10E-6	???	(further study required)
1,544kbit/s	10E-6	???	(further study required)
2.048Mbit/s	10E-6	???	(further study required)
