

**Technical Report: Service & Network
Requirements for 2.3GHz Portable Internet**

(English publication version)

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1. Purpose

2. Abbreviations

AAA	Authentication, Authorization, Charging
ACR	Access Control Router
BS	Base Station
DL	Downlink
EAP	Extensible Authentication Protocol
FRF	Frequency Reuse Factor
FTP	File Transfer Protocol
LAN	Local Area Network
MSS	Mobile Subscriber Station
PDA	Personal Digital Assistant
PKI	Public Key Infrastructure
RADIUS	Remote Authentication Dial-In User Services
SNMP	Simple Network Management Protocol
TBD	to be determined
UL	Uplink

_ Abbreviations can be changed later.

3. Service Overview

3.1 Service definition

Portable Internet Service is to provide a high data rate wireless internet access with MSS under the stationary or mobile environment, anytime and anywhere.

3.2 Service concept

- Under the stationary or mobile environment: service shall support stationary, nomadic, and medium-speed mobile users.
- Anytime and anywhere: service shall provide seamless connectivity regardless of the place and time.
- High data rate: service shall support the various types of wireless multimedia applications with a data rate of at least 1Mbps.
- MSS (Mobile Subscriber Station): service shall support the various types of multimedia-enabled terminals such as handset, notebook, PDA, or smart phone.

3.3 Service classes

3.3.1 Classification based on service characteristics

3.3.1.1 Real time service

- Definition: Service which imposes delay constraints while requiring the guaranteed resource allocation during the session.
- Examples: audio/video streaming, interactive game

3.3.1.2 Non real-time service

- Definition: Service which does not impose any delay constraints while requiring the guaranteed resource allocation during the session.
- Examples: FTP, multimedia mail, chatting, e-commerce

3.3.1.3 Best-effort service

- Definition: Service which does not impose any delay constraints while requiring no guaranteed resource allocation during the given service.
- Examples: Web browsing, e-mail

3.3.2 Classification based on system characteristics (TBD)

4. Service Requirement

4.1 Cell types and classification

- Cell types: Pico, Micro, Macro (for urban environment)
 - Pico cell: 100m
 - Micro cell: 400m
 - Macro cell: 1km

4.2 Service coverage

- Definition: Area that supports the portable internet service subject to the minimum data rate per user

Requirement: The following cell radius must be supported for the different cell types in the urban environment:

- Pico cell: 100m
- Micro cell: 400m
- Macro cell: 1Km

4.3 Mobility

System shall support mobile users at a velocity of up to 60km/h.

4.4 Hand-off

System shall support seamless IP-based service while users move from one cell to other.

4.5 Authentication and Security

System shall (authentication service should be provided to) prohibit 3rd party's unlawful usage and unlawful access network service except lawful user and terminal. And also, system shall support limiting (security service must be provided to limit) user's transmitting/receiving information outflow someone except its correspondent.

4.6 QoS

System shall provide different types of quality of service (QoS) , depending on subscriber's service classes.

4.7 Charging

System shall provide various basic data to support various charging rate, depending on subscriber's need.

4.8 Interworking with other network systems

System shall support interworking with other network systems such as wireless LAN and other mobile communication networks, etc.

4.9 Others

4.9.1 Multicast / Broadcast

System shall deliver (provide) the same information to a specific user group or all users.

4.9.2 Identification

System shall provide identification for international uniqueness without restricting

interworking with other network systems.

System shall provide internationally unique identification of user/MSS/BS without restricting interworking with other network systems.

4.9.3 Flexibility of Uplink / Downlink(slot) ratio

It shall be possible to change uplink and downlink ratio, depending on user data traffics when systems are set up or changed.

System shall support flexibility of uplink and downlink (slot) ratio, depending on on user data traffics when systems are set up or changed.

5. Network Requirements

5.1 Access network requirements

5.1.1 Frequency efficiency

5.1.1.1 Frequency reuse factor

- Definition: the number of cells in a cluster in which each cell uses a unique frequency channel without causing co-channel interference to each other, or equivalently, the number of cells which uses the same frequency channel simultaneously divided by the number of all cells in multi-cell environment.
- Requirement: FRF = 1 (all cells or sectors use the same frequency channel in multi-cell environment)

5.1.1.2 Spectral efficiency

- Definition:
 - Maximum spectral efficiency: maximum transmission data capacity divided by channel bandwidth that can be provided by a BS in a physical layer under a single cell environment (bps/Hz/cell or bps/Hz/sector).
 - Average spectral efficiency: average transmission data capacity divided by channel bandwidth that can be provided by a BS under a multi-cell environment (bps/Hz/cell or bps/Hz/sector).

* Note: Herein, the maximum and average frequency efficiencies are considered and thus, only their requirements are specified.

- Requirements:
 - Maximum frequency efficiency: DL/UL (6/2)
 - Average frequency efficiency: DL/UL (2/1)

5.1.2 Transmission Data Rate (service point of view)

5.1.2.1 Minimum transmission data rate per user

- Definition: Minimum transmission data rate either in uplink or downlink that can be provided by the system to a subscriber at a cell boundary under fully-loaded multi-cell environments in urban area (from service point of view); includes both user data and other control data.
- Requirement:
 - Uplink: 128kbps or higher
 - Downlink: 512kbps or higher

5.1.2.2 Maximum transmission data rate per user

- Definition: Maximum transmission data rate either uplink or downlink that can be provided by the system to a subscriber (as an input data rate to channel encoder); includes both user data and other control data
- Requirements:
 - Uplink: 1Mbps or higher
 - Downlink: 3Mbps or higher

5.1.2.3 Average transmission data rate per user [TBD]

5.1.3 QoS parameter

5.1.3.1 Definitions:

- Jitter: the variation of time interval between consecutive (sequential) packet arrivals over wireless access link
- Delay time: the time required for a packet delivery between MSS and BS over wireless access link
- Packet loss rate: the number of lost packets divided by the total number of transmitted packets over wireless access link
- Transmission data rate: the required transmission data rate to support QoS requirements over wireless access link

* Note: Herein, wireless access link is defined over layer 2 of BS and MSS

5.1.3.2 Requirements: [TBD]

5.1.4 Handoff

5.1.4.1 Definitions

To discuss the handoff, cell and sector are discussed as follows:

- Cell: service coverage supported by a BS in order to utilize frequency efficiently by dividing large area into smaller areas.
- Sector: service coverage divided by directivity of antennas in order to improve the efficiency of frequency utilization (capacity).

5.1.4.2 Types of handoff

- Inter-sector handoff: to support seamless IP-based service when the subscriber moves between sectors in a single cell
- Inter-cell handoff: to support seamless IP-based service when the subscriber moves between cells
- Inter-frequency handoff: to support seamless IP-based service when the subscriber moves between different frequencies.

5.1.4.3 Handoff requirement

	Handoff time
Inter-sector handoff	< 150ms
Inter-cell handoff	< 150ms
Inter-frequency Handoff	Inter-frequency handoff uses above results

* Handoff time is defined as an interval during which a packet transmitted is interrupted due to handoff process.

5.1.5 Capacity

5.1.5.1 Average throughput

- Definition: average transmission data rate divided by channel bandwidth that can be provided by a BS in a multi-cell environment (bps/Hz/cell (sector)).
- Value : DL/UL (2/1)

5.1.5.2 The number of simultaneous users

- Definition: the number of active sessions supporting the minimum transmission data rate per unit bandwidth

5.2 Core Network Requirement

5.2.1 Authentication and Security

- Authentication and secure key exchange scheme
 - System supports the authentication/security protocol based on EAP. If necessary, PKI-based protocol must be accommodated.
- Authentication Protocol
 - System supports the protocol based on RADIUS or Diameter for authentication.
- Authentication Function
 - System provides various functions of subscriber and MSS authentication.

5.2.2 Interworking with other networks

- Functionality:
Handoff and roaming shall be supported in order to maintain IP-based seamless service when the MSS in service moves to other networks. In the course of interworking with other networks, the following functions shall be supported:

- Authentication-related: to support authentication of other network services for inter-networking.
- Charging-related: to support Charging of other network services for inter-networking.
- Mobility-related: to guarantee IP mobility using mobile-IP, etc.

- Requirement:

Inter-IP subnet handoff time	< 1 second
Inter-network handoff time	Variable depending on the target network

5.2.3 Network management

System shall provide network management function (fault management, configuration management, performance management, etc.) using SNMP (Simple Network Management Protocol).

5.2.4 Mobility Support

When the MSS in the serving cell moves to other cell, system shall maintain the IP-based seamless service.

- To support L2-based mobility
- To support L3-based mobility

5.2.5 Charging management

System shall provide the following basic data in order to support various Charging management based on the characteristics of individual subscriber service:

- Connection time and disconnection time
- Amount of used data packets
- Identification for BS, subscriber, and MSS
- Service level (Class of Service; Grade of Service) and QoS
- Cause of call disconnection and error

5.2.6 Access Control Function

In order for a MSS to access network, the following access control functions shall be supported:

- Network access control
- Authentication
- Registration and address allocation
- Start of charging
- Traffic connection control.
- Traffic connection setup.
- Traffic connection change.
- Traffic connection termination.
- Access termination control.

- Registration termination and address reclaim
- End of charging

5.2.7 Transmission Control Function

Core Network shall provide the different QoS according to the service characteristics based on QoS which is set up in access network.

5.3 MSS requirement

5.3.1 Power Saving Function

MSS shall support a power saving function to minimize the power consumption.

5.3.2 Mobility Support

MSS shall support IP-based seamless service when it moves to another cell.

- To support L2-based mobility
- To support L3-based mobility

5.3.3 Multicast/Broadcast

MSS shall be able to receive multicast/broadcast data transmitted from the network.

5.3.4 Interworking with other networks

MSS shall be able to provide an appropriate method to control the connection when interworking with other networks.

5.3.5 Authentication and Security

a. Authentication and secure key exchange methods

MSS shall support the EAP-based authentication/security protocol based on EAP. If necessary, the PKI-based protocol shall be supported.

b. Authentication function

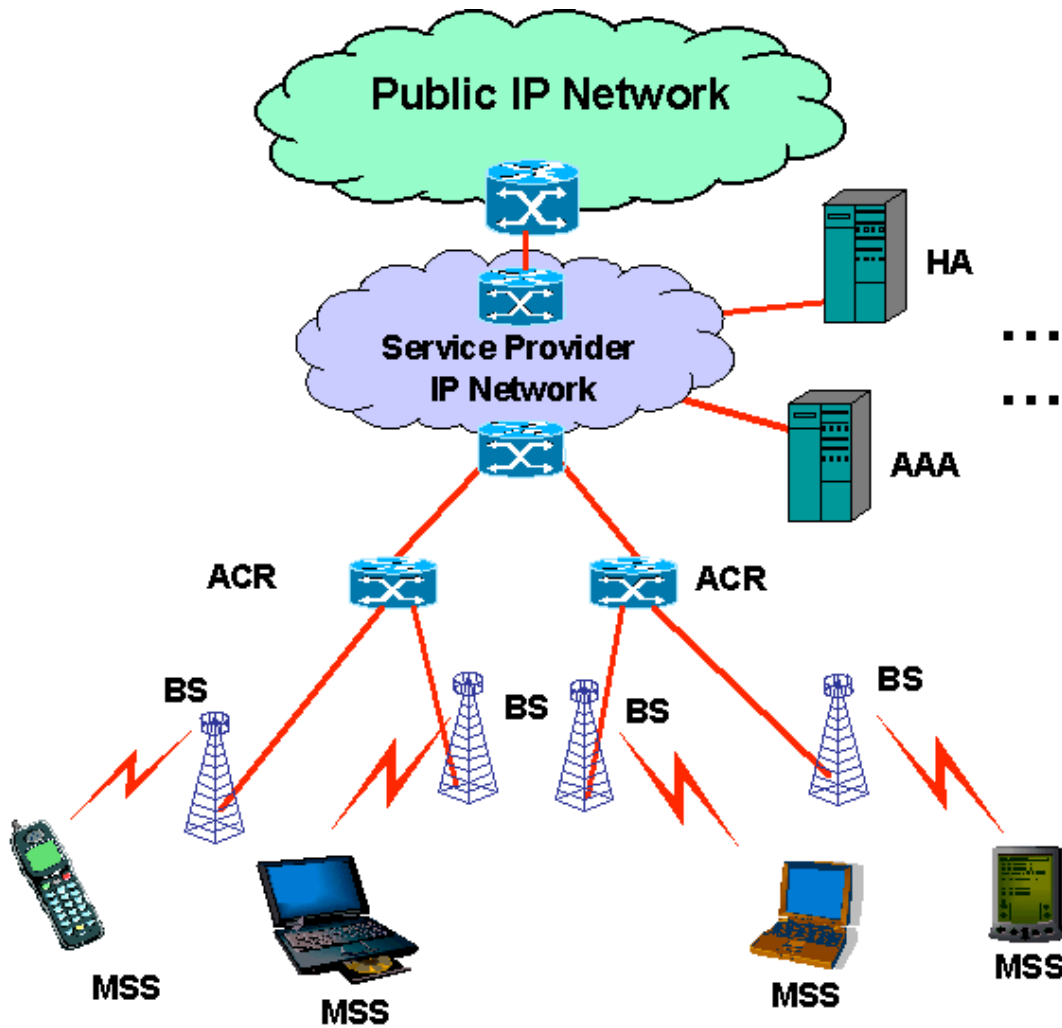
Various methods for subscribers and MSS authentication shall be provided.

c. Security function

Various cryptographic functions shall be provided.

PART 2. Network Reference Model

1. Network architecture



2. Entity

Following network entities shall satisfy the service and network requirements in this technical report. The most basic functions of each network entities are as follows:

2.1 Mobile Subscriber Station (MSS)

- Portable internet air interface-supporting function
- IP-based service access function
- IP mobility function
- MSS/subscriber authentication and security function
- Multicast service reception function
- Internetworking function with other networks

2.2 Base Station (BS)

- Portable internet air interface supporting function
- Radio resource management and control function
- Mobility (hand-off) support function
- Authentication and security function (It can be also done by ACR (Access Control Router))
- QoS function
- Downlink multicast function
- Charging, statistical data creation and report function (it can be also done by ACR)

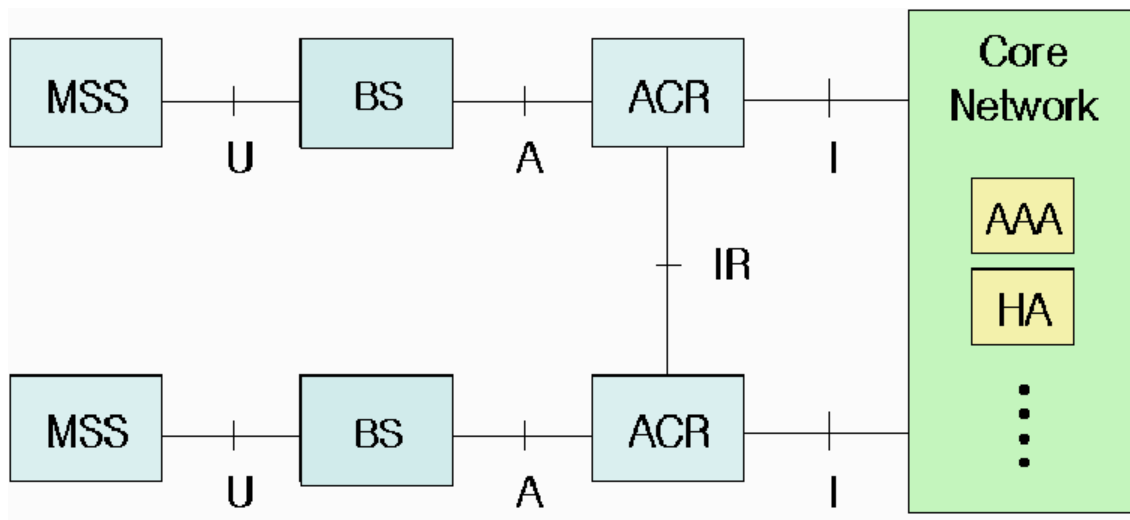
2.3 Access Control Router (ACR)

- IP routing and mobility management function
- Authentication and security function (it can be also done by BS)
- QoS function
- IP multicast function
- Charging service function to Charging server
- Mobility control (management) function between BSs within ACR
- Resources management and control function.

2.4 The Others

3. Network Reference Model

3.1 Reference model



3.2 Reference Point (Reference model)

3.2.1 U Interface

- Interface between MSS and BS

3.2.2 A Interface

- Interface between BS and ACR

3.2.3 IR Interface

- Interface between ACR and ACR

3.2.4 I interface

- Interface between ACR and Core network component (AAA, HA, etc.)