

## GSM - Specifications

Original specifications for the GSM system:

- Good subjective voice quality
- Low terminal and service cost
- Support for international roaming
- Support for handheld terminals
- Support for new services
- Spectrum efficient
- Compatible with ISDN





# GSM - Versions

System	Band	Uplink (MHz)	Downlink (MHz)	Channel number
T-GSM-380	380	380.2–389.8	390.2–399.8	dynamic
T-GSM-410	410	410.2–419.8	420.2–429.8	dynamic
GSM-450	450	450.6–457.6	460.6–467.6	259–293
GSM-480	480	479.0–486.0	489.0–496.0	306–340
GSM-710	710	698.2–716.2	728.2–746.2	dynamic
GSM-750	750	747.2–762.2	777.2–792.2	438–511
T-GSM-810	810	806.2–821.2	851.2–866.2	dynamic
GSM-850	850	824.2–849.2	869.2–894.2	128–251
<b>P-GSM-900</b>	<b>900</b>	<b>890.0–915.0</b>	<b>935.0–960.0</b>	<b>1–124</b>
E-GSM-900	900	880.0–915.0	925.0–960.0	975–1023, 0-124
R-GSM-900	900	876.0–915.0	921.0–960.0	955–1023, 0-124
T-GSM-900	900	870.4–876.0	915.4–921.0	dynamic
<b>DCS-1800</b>	<b>1800</b>	<b>1710.2–1784.8</b>	<b>1805.2–1879.8</b>	<b>512–885</b>
<b>PCS-1900</b>	<b>1900</b>	<b>1850.2–1909.8</b>	<b>1930.2–1989.8</b>	<b>512–810</b>

**P-GSM:** Standard or Primary GSM-900 Band

**E-GSM:** Extended GSM-900 Band (includes Standard GSM-900 band)

**R-GSM:** Railways GSM-900 Band (includes Standard and Extended GSM-900 band)

**T-GSM:** TETRA-GSM

The frequency band for GSM 900

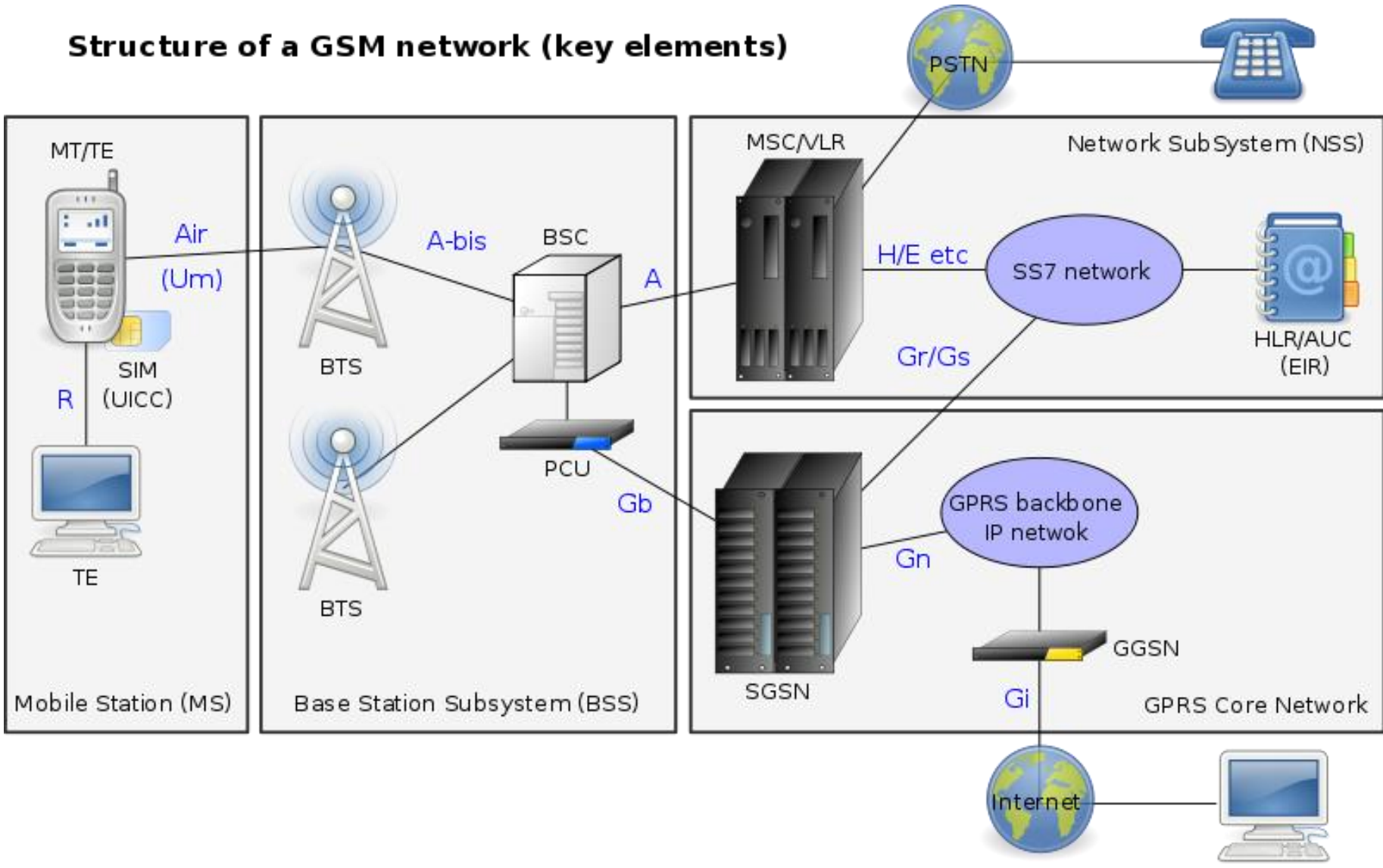
- uplink (reverse) is 890-915MHz,
- downlink (forward) is 935-960MHz.

The bandwidth for the GSM system is 25MHz, which provides 125 carriers uplink/downlink each having a bandwidth of 200 kHz. The ARFCN (Absolute radio frequency channel numbers) denotes a forward and reverse channel pair which is separated in frequency by 45 MHz.

- Mobile-to-base :  $F_u(n) = 890.2 + 0.2(n - 1)$  MHz
- Base-to-mobile :  $F_d(n) = F_u(n) + 45$  MHz

In practical implementations, a guard band of 100kHz is provided at the upper and lower end of the GSM spectrum, and only **124 (duplex) channels are implemented**.

Structure of a GSM network (key elements)



## **Base Transceiver Station (BTS)**

- Establishes and maintains connections to the MS
- Interface between MS and BTS is called Um interface.
- Hosts the Antenna and Radio Frequency hardware
- Contain software for multiple access
- BTSs and the BS are either co-located or are connected together
- Encodes, encrypts, multiplexes, modulates and feeds the RF signals to the antenna.
- Frequency hopping

## **Base Station Controller (BSC)**

- Has control Functionality
- Interface between BTS and BSC is called  $A_{bis}$  interface
- Responsible for, channel assignment, Maintenance of link quality, Handover Power Control, Coding

The **MSC** (mobile switching center) plays a central role in **GSM**

- switching functions
- additional functions for mobility support
- management of network resources
- interworking functions via Gateway MSC (GMSC)
- integration of several databases
- specific functions for paging and call forwarding
- termination of SS7 (signaling system no. 7)
- mobility specific signaling
- location registration and forwarding of location information
- provision of new services (fax, data calls)
- support of short message service (SMS)
- generation and forwarding of accounting and billing information

Databases (important: scalability, high capacity, low delay)

## **Home Location Register (HLR)**

- central master database containing user data,
- permanent and semi-permanent data of all subscribers assigned to the HLR (one provider can have several HLRs, however generally one HLR for each network operator)

## **Visitor Location Register (VLR)**

- Temporary database which updates whenever new MS enters its area, by HLR database
- Controls those mobiles roaming in its area
- Reduces number of queries to HLR
- Database contains IMSI, TMSI, MSISDN, MSRN, Location Area, authentication key
- Usually integrated with MSC so that geographic area covered by both coincides, signalling requirements simplified considerably

The OSS (Operation Subsystem) enables centralized operation, management, and maintenance of all GSM subsystems

## Components

- **Authentication Center (AUC)**
  - generates user specific authentication parameters on request of a VLR
  - authentication parameters used for authentication of mobile terminals and encryption of user data on the air interface within the GSM system
- **Equipment Identity Register (EIR)**
  - registers GSM mobile stations and user rights
  - stolen or malfunctioning mobile stations can be locked and sometimes even localized
- **Operation and Maintenance Center (OMC)**
  - different control capabilities for the radio subsystem and the network subsystem