

What is an IMSI Number, and How is it Related to MCC and MNC?

TechRounder PDF Edition

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In brief

An IMSI (International Mobile Subscriber Identity) is a unique number, up to 15 digits long, stored on a SIM card that identifies a mobile phone user on a cellular network.

An International Mobile Subscriber Identity (IMSI) is a unique number that is used to identify a mobile phone user on a cellular network. It is stored on the SIM card inside a mobile device and is sent to the network to identify the user. The IMSI is a 64-bit field that can be up to 15 digits long. It is defined by the ITU-T E.212 international numbering standard. The IMSI is used in GSM, UMTS, LTE and other mobile networks that interconnect with each other. The IMSI should not be confused with the ICCID, which is the identifier for the physical SIM card itself. The IMSI is part of the user profile stored on the SIM card.

Structure of the IMSI

The IMSI is composed of three main parts:

1. Mobile Country Code (MCC) - 3 digits
2. Mobile Network Code (MNC) - 2 or 3 digits
3. Mobile Subscription Identification Number (MSIN) - 9 to 10 digits

The MCC uniquely identifies the country of the mobile network. The MNC identifies the home network of the mobile subscriber within that country. The MSIN identifies the mobile subscriber within that network's customer base. So the IMSI has the following structure: MCC + MNC + MSIN. For example, an IMSI might look like this: 310150123456789. Where:

- 310 is the MCC for the United States
- 150 is the MNC for AT&T Mobility
- 123456789 is the MSIN identifying the specific subscriber

Mobile Country Code (MCC)

The Mobile Country Code (MCC) is the first 3 digits of the IMSI. It uniquely identifies the country of domicile of the mobile subscriber. MCCs are defined by the ITU-T E.212 numbering plan. The first digit of the MCC identifies the geographic region:

- 2 - Europe
- 3 - North America and the Caribbean
- 4 - Asia and the Middle East
- 5 - Oceania
- 6 - Africa
- 7 - South and Central America

The digits 1 and 8 are not currently used. 9 is reserved for future global services. Some example MCCs:

- 208 - France
- 234 - United Kingdom
- 310 - United States
- 404 - India
- 505 - Australia
- 655 - South Africa

A full list of MCCs can be found in the ITU-T E.212 specification. As of 2021, there are around 250 assigned MCCs.

Mobile Network Code (MNC)

The Mobile Network Code (MNC) follows the MCC in the IMSI. It consists of either 2 or 3 digits that identify the mobile subscriber's home network. Historically, European and other countries followed the ITU-T E.212 recommendation which specified 2-digit MNCs. However, the North American Numbering Plan used 3-digit MNCs from the beginning for AMPS networks. Over time, some countries have transitioned from 2-digit to 3-digit MNCs due to the need for more networks.

The length of the MNC depends on the value of the MCC. It is recommended that MNC length is kept uniform within an MCC. A mixture of 2 and 3 digit MNCs is used in some countries like the United States. The MNC is used in combination with the MCC to uniquely identify a mobile network operator globally. This MCC+MNC tuple is used in the signaling network and transmitted by base stations to identify the operator. Some example MNCs: France (MCC 208)

- 01 - Orange
- 10 - SFR
- 20 - Bouygues

United States (MCC 310)

- 004 - Verizon
- 120 - Sprint
- 150 - AT&T
- 260 - T-Mobile

India (MCC 404)

- 01 - Vodafone Idea
- 10 - Bharti Airtel
- 20 - Reliance Jio
- 86 - BSNL

The MNC is assigned by the national numbering authority in each country. Lists of MNCs for each MCC are published by the ITU.

Mobile Subscription Identification Number (MSIN)

The Mobile Subscription Identification Number (MSIN) is the last part of the IMSI. It uniquely identifies a mobile subscription within a network. The MSIN is 9-10 digits long, depending on the length of the MNC. If the MNC is 2 digits, the MSIN will be 10 digits. If the MNC is 3 digits, the MSIN will be 9 digits. This keeps the total IMSI length within 15 digits. The MSIN format and allocation is up to each mobile network operator. It identifies the mobile subscriber within the operator's customer base.

Along with the MCC+MNC, it allows each mobile user to be uniquely identified globally. When a user roams onto another network, the IMSI is used to retrieve their subscription information from the home location register (HLR) in their home network. For security reasons, the IMSI is sent over the radio network as rarely as possible. A Temporary Mobile Subscriber Identity (TMSI) is sent instead to avoid identifying and tracking a user.

Conclusion

In summary, the International Mobile Subscriber Identity (IMSI) is a globally unique number that identifies a mobile user. It is up to 15 digits long and consists of three parts:

1. Mobile Country Code (MCC) - 3 digits identifying the country
2. Mobile Network Code (MNC) - 2 or 3 digits identifying the mobile network
3. Mobile Subscription Identification Number (MSIN) - 9 or 10 digits identifying the subscriber

The MCC and MNC together identify the user's home network operator. The MSIN identifies the individual user within that network. The IMSI is stored on the SIM card and used by the network for authentication, billing, and retrieving the user's profile from their home network when roaming. It is a critical identifier in mobile networks around the world.