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2G, 3G Network Planning and Optimization...

Live

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              ↗
31 ДЕНЬ    724
           195
07 ДНЕЙ    136
            47
24 ЧАСА      94
            11
СЕГОДНЯ      18
             3
НА ЛИНИИ     76
             4
```

Hit

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Постоянные читатели

четверг, 1 октября 2009 г.

When operators prepare to construct a mobile communication network, they must predict coverage according to traffic prediction and local radio propagation environment. This guides project design of the system and parameter configuration of radio network.

The project design includes the following aspects:

- Network topology design
- Selecting the location of base station
- Frequency planning
- Cell parameter configuration

The RF planning determines the coverage range of a cell, and the serving range of the cell is determined based on the combination of RF planning and cell parameter configuration. By this, the MS always enjoys optimal services and maximum network capacity at the best cell.

This chapter discusses the meaning and effect of important parameters in GSM radio communication. Mastering the effect and impact of these parameters helps to configure network parameters and optimize the network in later stages.

In a GSM network, abundant radio parameters are configured according to cells or partial areas; however, the parameter configuration might affect neighbor areas. Therefore, while configuring and adjusting parameters, you must pay attention to the impact of configuring parameters on other areas, especially neighbor areas.

4.1 Network and Cell ID

4.1.1 Cell Global ID

I. Definition

GSM is a global cellular mobile communication system. To ensure that each cell corresponds to a unique ID globally, the GSM system numbers the following items:

- Each GSM network in each country
- Each location area
- Each base station
- Each cell

Numbering the previous items aims as follows:

- An MS can identify the serving network so that the MS can select a network in any environment.
- The network can obtain the precise location of the MS so that the network can process various service requests involving the MS.
- The MS can report information about neighbor cells to the network during calling to avoid call drop.

The cell global identity (CGI) is a major network identity parameter. CGI consists of location area identity (LAI) and cell identity (CI). LAI includes mobile country code (MCC), mobile network code (MNC), and location area code (LAC).

The system transmits CGI information through system information (SI) transmitted by cell broadcast. When an MS receives SI, it demodulates SI for CGI information. The MS judge whether to camp on the cell according to the MCC and MNC. It also judges whether the current location area changes to determine updating location. While updating location, the MS reports LAI information to the network so that the network can know the location area of the MS.

II. Format

The CGI is MCC-MNC-LAC-CI, with details as follows:

- MCC consists of three decimal digits, ranging from 000 to 999.
- MNC consists of two decimal digits, ranging from 00 to 99.
- LAC ranges from 0 to 65535.
- CI ranges from 0 to 65535.

III. Configuration and Influence

As a globally unique mobile identity, the MCC is uniformly distributed and managed by international telecommunication union (ITU). The MCC for China is 460 (decimal).

The MNC is uniformly distributed by state telecommunication management organs. Now two GSM networks exist in China. The MNC for China Mobile is 00. The MNC for China Unicom is 01.

The method for coding LAC is ruled by each country accordingly. This caters for China also (refer to GSM system from Ministry of Information Industry). At the early stage of network construction, the LAC is coded and distributed. The LAC is seldom changed in the later stages.

The coverage areas related to the LAC is vital in the network. You can configure it as great as possible.

No special restriction is on the distribution of CI. The CI ranges from 0 to 65535 (decimal). It must be ensured that two equivalent CIs exist in the same location area. This is determined in the system design. Except for special situations (such as constructing base stations), the CI must not be changed during the system operation.

IV. Precautions

You must pay attention to the following aspects:

- The MNC is unchangeable.
- While configuring the LAC, you must follow related regulations. Equivalent LACs must not exist in the state network.
- Equivalent CIs must not exist in the same location area.

4.1.2 Base Station Identity Code

I. Definition

In a GSM network, each base station corresponds to a distributed local color code, called base station identity code (BSIC). When the MS receives broadcast control channel (BCCH) carriers of two cells at the same time, with same channel number, the MS distinguishes them by BSIC.

In network planning, the BCCH carriers of neighbor cells are different in frequency to reduce intra-frequency interference. The cellular communication system features that the BCCH carrier might be reused. Therefore, the BSIC of the cells with the same BCCH carrier must be different.

The system transmits BSIC on synchronization channel (SCH) of each cell. The effect of BSIC is as follows:

- The BSIC involves in decoding process of random access channel (RACH) to prevent base stations from connecting to the RACH sent to the neighbor cells by the MS by error.
- After the MS receives SCH messages, it judges that it has been synchronous to the cell. Decoding information on the downlink common signaling channel correctly requires training sequence code (TSC) used on common signaling channel. GSM regulations describe TSC in eight fixed formats, and the sequence number of them is 0–7. The cell BCC determines the TSC used by the common signaling channel of a cell. Therefore the BSIC helps inform the MS of the TSC used by the common signaling channel of the serving cell.
- In a call, the MS must measure the level of BCCH carrier of neighbor cells and report it to the base station according to regulations to neighbor cell list of BCCH. Meanwhile, the MS must provide measured BSIC of the carrier in the uplink measurement reports. When the neighbor cells of a cell include two or more cells with the same BCCH carrier, the base station can distinguish the cells by BSIC to avoid incorrect handover.
- In a call, the MS must measure signals of neighbor cells, and sends measurement reports to the network. The measurement report can contain information about six neighbor cells only, so the MS must be controlled to report the cells actually related to handover. The first three digits of BSIC (namely, NCC) aims as previously mentioned. Operators control the MS to report the neighbor cell information permitted by the serving cell NCC by broadcast parameters **NCC permitted**.

II. Format

The BSIC is NCC-BCC, with details as follows:

- The NCC ranges from 0 to 7.
- The BCC ranges from 0 to 7.

III. Configuration and Influence

Usually different GSM PLMNs use the same frequency resource, but, to some degree, their network planning is independent. The neighbor GSM PLMNs use different NCCs according to regulations. This ensures that the neighbor base stations with same frequency use different BSICs.

The BCC is part of the BSIC. It helps identify different base stations with same BCCH carrier number in the same GSM PLMN. The values of BCC must meet the previous requirements. According to GSM regulations, the TSC of cell BCCH carrier must be same as that of cell BCC. The equipment providers must ensure the TSC consistency.

IV. Precautions

The neighbor cells or cells nearby using the same BCCH carrier must use different BSICs. Especially when two or more cells use the same BCCH carrier in the neighbor cell list of a cell, theses cells must use different BSIC. Pay attention to cells at the bordering areas

between provinces and cities, and otherwise cross-cell handover might fail and abundant mistaken access problems might occur.

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