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4.8 Handover and Related Parameters

4.8.1 PBGT Handover Threshold (HoMargin)

I. Definition

The PBGT handover threshold is power handover tolerance (handover in serving areas). When the signal level of neighbor cell is hoMargin (dB) higher than that of the serving cell, handover occurs. Complex radio propagation conditions cause fluctuation of signal level. Using handover tolerance avoids frequent handover at bordering areas. The PBGT handover threshold is similar to HO_MARGIN (GSM 05.08).

II. Format

The PBGT handover threshold ranges from 0 to 127, corresponding to –64 dB to +63 dB. The reference value for suburban areas is 68. The reference value for urban areas is 70 to 72.

III. Configuration and Influence

The PBGT handover threshold aims to adjust handover difficulty properly, and to avoid ping-pong handover. If it is configured over great, the handover is delayed and handover is less efficient. When it is smaller than 64, the MS hands over from the serving cell to the neighbor cell with lower level.

4.8.2 Minimum Downlink Power of Handover Candidate Cells (rxLevMinCell)

I. Definition

It is the minimum allowed access level for a cell to be a neighbor cell. When the cell level measured by MS is greater than the threshold, the BSS list the cell into candidate cell list for handover judgment.

II. Format

It ranges from –110 dBm to –47 dBm.

III. Configuration and Influence

It is helpful in the following two aspects:

- It guarantees communication quality.
  For a common single layer network structure, the value ranges from –90 dBm to –80 dBm.
- It helps allocate traffic between cells averagely.
  Especially in multi-layer network structure, to maintain MS in a network layer, you can increase the level of the cell of the network layer (such as –70 dBm), and also decrease that in other cells.

IV. Precautions

You cannot configure rxLevMinCell over great (over –65 dBm) or over small (lower than –95 dBm), and otherwise communication quality is affected.

4.8.3 Handover Threshold at Uplink Edge

I. Definition

If the uplink received level keeps being smaller than the handover threshold at uplink edge for a period, edge handover can be performed.

II. Format

It ranges from 0 to 63, corresponding to –110 dBm to –47 dBm. The recommended values are as follows:

- Configure it to 25 in urban areas without PBGT handover.
- Configure it to 20 in single site of suburban areas.
- Configure it to 20 in urban areas with PBGT handover

III. Configuration and Influence

When PBGT handover is enabled, the corresponding edge handover threshold can be lowered. When PBGT handover is disabled, and the edge handover threshold is over low, an artificial cross-cell non-handover occurs. Therefore call drop occurs or intra-frequency and side interference occur due to cross-cell talk.

4.8.4 Handover Threshold at Downlink Edge

I. Definition

If the downlink received level keeps being smaller than the handover threshold at downlink edge for a period, edge handover can be performed.

II. Format

It ranges from 0 to 63, corresponding to –110 dBm to –47 dBm. The recommended values are as follows:

- Configure it to 30 in urban areas without PBGT handover.
- Configure it to 25 in single site of suburban areas.
- Configure it to 25 in urban areas with PBGT handover

III. Configuration and Influence

When PBGT handover is enabled, the corresponding edge handover threshold can be lowered. When PBGT handover is disabled, and the edge handover threshold is over low, an artificial cross-cell non-handover occurs. Therefore call drop occurs or intra-frequency and side interference occur due to cross-cell talk.

4.8.5 Downlink Quality Restriction of Emergency Handover

I. Definition

If the downlink received quality is lower than the threshold of downlink quality restriction of emergency handover, the quality difference emergency handover occurs.

II. Format

It ranges from 0 to 70, corresponding to RQ (QoS 0 to 7) x 10.
The recommended value is 50.

III. Configuration and Influence

When frequency hopping is enabled, the voice quality is better with the same RQ, you can configure it to 60 or 70. When emergency handover occurs, the intracell handover occurs first. If there are no other candidate cells, and the intracell handover is enabled, the intracell handover occurs.

4.8.6 Uplink Quality Restriction of Emergency Handover

I. Definition

If the uplink received quality is lower than it, quality difference emergency handover is triggered.

II. Format

It ranges from 0 to 70, corresponding to RQ (QoS 0 to 7) x 10.
The recommended value is 50.

III. Configuration and Influence

When frequency hopping is enabled, the voice quality is better with the same RQ, you can configure it to 60 or 70. When emergency handover occurs, the intracell handover occurs first. If there are no other candidate cells, and the intracell handover is enabled, the intracell handover occurs.

4.8.7 Uplink Quality Threshold of Interference Handover

I. Definition

It is the uplink received quality threshold of the serving cell that triggers interference handover. The interference handover is triggered if all the following conditions are met:

- The uplink received level is higher than the uplink received power threshold of interference handover.
- The uplink received quality is lower than the uplink quality threshold of interference handover.

When handover switch is enabled, the interference handover occurs within the cell by preference.

II. Format

It ranges from 0 to 70, corresponding to RQ (QoS 0 to 7) x 10.
The recommended value is 50.

III. Configuration and Influence

When frequency hopping is enabled, the voice quality is better with the same RQ, you can configure it to 60 or 70. When interference handover is triggered, select the candidates according to the sorted result. If the serving cell ranks first and its intracell handover is enabled, the MS selects the serving cell; otherwise it selects the second candidate cell.

4.8.8 Downlink Quality Threshold of Interference Handover

I. Definition

It is the downlink received quality threshold of the serving cell that triggers interference handover. The interference handover is triggered if all the following conditions are met:

- The downlink received level is higher than the downlink received power threshold of interference handover.
- The downlink received quality is lower than the downlink quality threshold of interference handover.

When handover switch is enabled, the interference handover occurs within the cell by preference.

II. Format

It ranges from 0 to 70, corresponding to RQ (QoS 0 to 7) x 10.

The recommended value is 50.

III. Configuration and Influence

When frequency hopping is enabled, the voice quality is better with the same RQ, you can configure it to 60 or 70. When interference handover is triggered, select the candidates according to the sorted result. If the serving cell ranks first and its intracell handover is enabled, the MS selects the serving cell; otherwise it selects the second candidate cell.

IV. Precautions

The interference handover quality must be better than emergency handover quality.

4.8.9 Uplink Received Power Threshold of Interference Handover

I. Definition

If interference handover occurs due to uplink quality, the serving cell must reach the minimum uplink received power threshold. If this is met, the system judges that uplink is interfered, so interference handover is triggered.

The interference handover is triggered if all the following conditions are met:

- The uplink received level is higher than the uplink received power threshold of interference handover.
- The uplink received quality is lower than the uplink quality threshold of interference handover.

When handover switch is enabled, the interference handover occurs within the cell by preference.

II. Format

It ranges from 0 to 63, corresponding to –110 dBm to –47 dBm.

The recommended value is 25.

III. Configurationa and Influence

When interference handover is triggered, select the candidates according to the sorted result. If the serving cell ranks first and its intracell handover is enabled, the MS selects the serving cell; otherwise it selects the second candidate cell.

4.8.10 Downlink Received Power Threshold of Interference Handover

I. Definition

If interference handover occurs due to uplink quality, the serving cell must reach the minimum downlink received power threshold. If this is met, the system judges that downlink is interfered, so interference handover is triggered.

The interference handover is triggered if all the following conditions are met:

- The downlink received level is higher than the downlink received power threshold of interference handover.
- The downlink received quality is lower than the downlink quality threshold of interference handover.

When handover switch is enabled, the interference handover occurs within the cell by preference.

II. Format

It ranges from 0 to 63, corresponding to –110 dBm to –47 dBm.

The recommended value is 30.

III. Configurationa and Influence

When interference handover is triggered, select the candidates according to the sorted result. If the serving cell ranks first and its intracell handover is enabled, the MS selects the serving cell; otherwise it selects the second candidate cell.

4.8.11 Maximum Repeated Times of Physical Messages (NY1)

I. Definition

In asynchronous handover process of GSM system, when the MS receives handover messages of the network, it sends handover access messages on the target channel. After the network receives the message, it does as follows:

1) Calculate related RF features.
2) Send physical messages (it the channel messages are encrypted, start encryption and decryption algorithm) in unit data to MSs.
3) Start timer T3105.

If the network does not receive correct layer 2 frames sent by MS until expiration of T3105, the network will resend the physical message and restart T3105. The maximum times for resending physical messages is determined by the parameter maximum repeated times of physical messages (NY1)

II. Format

NY1 ranges from 0 to 254.

The recommended value is 20.

III. Configuration and Influence

When the network receives the handover access messages sent by MS, the physical channel (PCH) needs to be synchronous. If the communication quality on channels is guaranteed, the MS can receive physical messages correctly and send layer 2 frames to the network.

If the physical messages are sent multiple times, and the network cannot receive layer 2 frames sent by MS, the PCH is too poor to communicate normally. Though link is setup after multiple trials, the communication quality is not guaranteed. This lowers the utilization of radio resources. Therefore configure NY1 to a smaller value.

IV. Precautions

Configuring NY1 is affected by T3105. If T3105 is configured to a short value, then the NY1 needs to be increased accordingly.

If a handover trial fails before the original cell receives the HANDOVER FAILURE message, and the T3105 of the target cell expires for Ny times, the target BTS sends a CONNECTION FAILURE INDICATION message to the target BSC. Though the MS might return to the original channel, the traffic measurement counters from multiple vendors will take statistics of connection failure.

To avoid the previous phenomenon, configure T3105 as follows:

Ny * T3105 > T3124 + delta (delta: the time between expiration of T3124 and receiving HANDOVER FAILURE message by original BTS)

4.8.12 Multiband Indicator (multiband_reporting)

I. Definition

In a single band GSM network, when the MS send measurement reports of neighbor cells to the network, it needs to report the content of the six neighbor cells with strongest signals.

In a multiband network, operators wish that MS uses a band by preference in cross-cell handover. Therefore the MS sends measurement reports according to signal strength and signal band. The parameter multiband indicator indicates MS to report content of multiband neighbor cells.

II. Format

The multiband indicator ranges from 0 to 3, with meanings as follows:

- 0: According to signal strength of neighbor cells, the MS must report six allowed measurement reports of neighbor cells with strongest signals and known NCC, with the neighbor cells in whatever band.
- 1: The MS must report the allowed measurement report of a neighbor cell with known NCC and with strongest signals at each band expect for the band used by the serving cell. The MS must also report the neighbor cells of the band used by the serving cell in rest locations. If there are other rest locations, the MS must report conditions of other neighbor cells in any band.
- 2: The MS must report the allowed measurement report of two neighbor cells with known NCC and with strongest signals at each band expect for the band used by the serving cell. The MS must also report the neighbor cells of the band used by the serving cell in rest locations. If there are other rest locations, the MS must report conditions of other neighbor cells in any band.
- 3: The MS must report the allowed measurement report of three neighbor cells with known NCC and with strongest signals at each band expect for the band used by the serving cell. The MS must also report the neighbor cells of the band used by the serving cell in rest locations. If there are other rest locations, the MS must report conditions of other neighbor cells in any band.

III. Configuration and Influence

In multiband networks, it is related to traffic of each band. For configuration, refer to the following rules:

- If the traffic of each band is approximately equal, and operators do not select a band intentionally, you can configure the multiband indicator to 0
- If the traffic of each band is obviously different, and operators want MS to select

a band by preference, you can configure the multiband indicator to 3.

- For situations between the previous two, configure multiband indicator to 1 or 2.

4.8.13 Permitted Network Color Code (ncc permitted)

I. Definition

During a talk, the MS must report the measured signals of neighbor cells to the base station, but each report includes only six neighbor cells. Therefore the MS is configured to report the potential handover target neighbor cells, instead of reporting unselectively and according to signal level.

To enable previous functions, restrict MS to measure the cells with the fixed network color code (NCC). The NNC allowed by parameters list the NCCs of the cells to be measured by MS. The MS compares the measured NCC of neighbor cells and NCCs set allowed by parameters. If the measured NCC is in the set, the MS reports the NCC to the base station; otherwise, the MS discard the measurement report.

II. Format

The parameter ncc permitted is a bit mapping value, consisting of 8 bits. The most significant bit is bit 7 while the least significant bit is bit 0. Each bit corresponds to an NCC code 0 to 7 (see GSM regulations 03.03 and 04.08).

If the bit N is 0 (N ranges from 0 to 7), the MS needs not to measure the level of the cell with NCC of N. Namely, it only measures the signal quality and level of the cells corresponding to bit number of 1 in NCC and ncc permitted configuration.

III. Configuration and Influence

Each area is allocated with one or more NCCs. In the parameter ncc permitted of the cell, the local NCC is absolutely and only included. If excluded, abnormal handover and call drop occur. For normal roaming between areas, the NCC of neighbor areas must be included in the edge cells of an area.
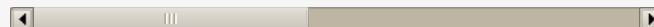
IV. Precautions

Improper configuration of the parameter causes normal handover and even call drop. The parameter only affects behaviors of MS.

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