7.Authentication

Authentication will be performed after handover (for further study).

8.Handling of supplementary services

This is for further study. MAP procedures for supporting such functions are contained in Recommendation Q.1051.

MSC-A will maintain call control until all operations, i.e. the existing call and any supplementary service operation have been terminated. At this instant, MSC-B is informed by the end signal message of the MAP that all functions in MSC-B can be released.

If the call waiting service is provided for the called MS, and there are calls waiting at the time of a handover to another MSC, these calls should be established by MSC-A using normal call forwarding to MSC-B. If the MS requests holding of the existing call and connection of a waiting call, the MAP is used to provide the necessary exchange of information between MSC-A and the MS.

9.Location updating after handover

MSC-B (or VLR-B) should not initiate automatic updating of the HLR at the end of the call. The procedures in the MS should be such that the MS should initiate updating after the call has been completed and the MS has tuned to a common control channel.

Automatic updating by MSC-B (or VLR-B) is for further study.

(Recoup 17 pages)

and establishment of the new radio channel. The procedure is outlined in § 4.1.

ii) Subsequent handover within the area controlled by MSC-B (states 4, 5, 6 and 7). This procedure is essentially the same as that of ii) of § 5.3.

iii) Subsequent handover to another MSC (MSC-A or MSC-B') (states 4, 8 and 9). The initiation procedure is essentially the same as that of i) of § 5.3. The HA-INDICATION is now generated by MSC-B after a subsequent handover accepted indication is received from MSC-A (via functional unit 4). The procedure is terminated in MSC-B when MSC-B receives a terminate procedure indication from functional unit 4.

Timers in MSC-B

The procedures are supervised by timers in order to avoid deadlock when responses are not received or the procedures fail. The following timers are defined.

T200:This timer is the same as T100 (§ 5.3).

T201: This timer is the same as T101 (§ 5.3).

T202:This timer is the same as T102 (§ 5.3).

T204:This timer is the same as T104 (§ 5.3).

T210:This timer is used to supervise the time for establishing a connection from MSC-A to MSC-B after an allocate radio channel request has been received. When T210 expires, the allocated channel in MSC-B is released. T210 = (FS)

T211:This timer is used to control the time between requesting a subsequent handover and receiving the response from MSC-A. If T211 expires, the existing connection with the MS is maintained. T211 = (FS)

6.4MAP procedures MSC-B (functional unit 4)

The MAP procedures for handover are defined in Recommendation Q.1051. They include:

- requesting measurements in other MSCs,

- procedures for basic handover,

- procedures for subsequent handover, and

- procedures for obtaining and releasing MS roaming number for handover from the VLR.

These procedures are outlined in § 4.

Note - The answer signal is not related to answering by the MS and if has no meaning in the handover procedure between MSC-A and MSC-B. But after successful handover this signal is needed for bringing the connection in the answered state in the intermediate PSTN/ISDN exchanges.

There will be no indication that the call applies to a handover. This information has to be derived from the MS roaming number received during call set up in relation to the earlier radio channel request/radio channel acknowledgement procedure between MSC-A and MSC-B (MAP-procedure).

When the connection has been established an indication should be given to functional unit 3 (illustrated by the signal "connection established" in Figure 11/Q.1005).

Call clearing

The call clearing consists of two parts after inter MSC handover, clearing of the BS-MS connection and clearing of the inter MSC connection.

The MAP is used to transfer information between MSC-B and MSC-A in order to make it possible for MSC-B to send the appropriate signals and still leave the call control to MSC-A.

MSC-A initiates release of the connection between MSC-A and MSC-B.

MSC-B is only allowed to initiate inter MSC connection release after the end signal is received.

When the Signalling System No. 7 - ISDN User Part is used, the normal symmetric release procedures apply.

When a signalling system is used without a symmetric release possibility, the following applies.

- When MSC-B receives a clear-forward signal from MSC-A, it shall release the radio path.

- In fault situations, e.g. machine malfunction or loss of the connection on interface A, MSC-B may send a clear-back signal to MSC-A.

6.3 Handover control procedures MSC-B (functional unit 3)

The procedures of functional unit 3 are given in the form of SDL diagrams in Figure 11/Q.1005. For all signals sent to or received from another functional unit the source or sink of the signal is indicated (e.g. from 4,
to 2, etc.).

The procedures in functional unit 3 include the following.

i) Handover from MSC-A (states 1, 2, 3 and 4). This case includes initiation by MSC-A (indicated by the allocate radio channel signal received from functional unit 4) and allocation

radio channel is released and the existing handover device connection to MSC-B is maintained. T104 = (FS)

5.4MAP procedures in MSC-A (functional unit 4)

The MAP procedures for handover are defined in Recommendation Q.1051. They include:

- requesting measurements in other MSCs;
- procedures for basic handover; and
- procedures for subsequent handover.

These procedures are as outlined in § 4.

6.Detailed procedures in MSC-B

6.1BS/MSC (MS/BS) procedures MSC-B (functional unit 1)

The handover procedures in this functional unit consist of:

i) signalling between the MS and the MSC; and

ii) signalling between the BS and the MSC for

- initiation of quality measurements, and
- access management.

Signals exchanged with functional unit 3 are indicated in § 6.3 below.

6.2Call control procedures MSC-B (functional unit 2)

These procedures relate to the call control in MSC-B of the "handover" connection with MSC-A. For these procedures the following apply.

Call set-up

The connection is set-up by MSC-A. MSC-B should provide, if possible, the following backward signals:

- signals indicating unsuccessful call set up and, if possible, the cause of call failure;
- address complete signal; and
- answer signal (see note).

The handover device is set up when MSC-A send the HA-INDICATION, i.e. the interfaces A', B' and B" are connected. The device is connected in its final position (i.e. B' to B") when either the HA-CONFIRM signal is received from the MS or the successful procedure indication is received from functional unit 4.

iv) Subsequent handover to MSC-A (states 7 and 9). This procedure is described in § 4.2. When a handover to MSC-A indication is received from functional unit 4, the handover device is set up so that interfaces B', B" and A' are connected. When HB-CONFIRM is received, the device is connected in its final position (i.e. B' to A').

If HB-CONFIRM is not received (expiry of timer T104), the handover device releases interface A' and returns to a position where B' and B" are connected. A congestion indication is returned via functional unit 4 to MSC-B.

v) Subsequent handover to a third MSC (MSC-B') (states 7 and 8). The procedure is described in § 4.2. The handover device is set up in its initial position, i.e. interconnection of interfaces B', B" and B"', when the connection to MSC-B' has been established (indicate by the signal connection established from functional unit 2). MSC-B is informed via functional unit 4 (send acknowledge) that the connection has been established and that the procedure on the radio path can be initiated. The device is connected in its final position (i.e. B' to B"') when a successful procedure indication in received from functional unit 4. MSC-B is informed that all procedures in MSC-B can be terminated (illustrated by the send-end signal indication). The device returns to the state where B' and B" are connected if the subsequent handover procedure fails.

Timers in MSC-A

The procedures are supervised by timers in order to avoid deadlock when responses are not received or the procedures fail. The following timers are defined.

T100:This timer supervises the time between sending a request for measurements to a BS or an MSC and the receipt of the results. Results received after time out are ignored. T100 = (FS)

T101:This timer supervises the queuing time for a free channel. If T101 expires, a no channel indication is generated. T101 = (FS)

T102:This timer supervises the time for handover completion for handover between BSs in MSC-A. If T102 expires, the radio path and the connection on interface B' are released. T102 = (FS)

T103:This timer supervises the time between issuing a HA-INDICATION in MSC-A and receiving a successful procedure indication from MSC-B. If T103 expires, the handover procedure is cancelled and either the radio channel is released (if HA-CONFIRM has been received) or it continues on the old channel (if HA-CONFIRM has not been received). T103 = (FS)

T104:This timer supervises the time between sending an HB-INDICATION and receiving the HB-CONFIRM for a subsequent handover from MSC-B to MSC-A. If T104 expires, the new

- for international connections MSC-A sends a clear-forward signal on both interface B' to the fixed network and interface B" to MSC-B; and

- for national connections a timer is started according to national practice for clear-back supervision and MSC-A proceeds as follows:

i) if a clear-back signal is received from MSC-B, MSC-A interprets this as indicating a clear-forward condition and proceeds by clearing the connections on interface B' and to MSC-B by normal clear-forward procedures, or

ii) if the timer expires, MSC-A proceeds by normal clear- forward of the connections on interface B' to MSC-B.

5.3 Handover control procedures MSC-A (functional unit 3)

The procedures of functional unit 3 are given in terms of SDL diagrams in Figure 10/Q.1005. For all signals sent to or received from another functional unit the source or sink of the signal is indicated (e.g. from 4, to 2, etc.).

The procedures of functional unit 3 include the following.

i) Initiation (states 1, 2 and 3). The initiation condition is shown by the signal HA-REQUEST. This may either be generated by the MS or the BS depending on the initiation condition (see § 3). The diagram includes all possibilities described in § 3, i.e. the MS identifies the new BS, or the new BS is identified by the MSC by measurements in adjacent BSs. These may include BSs in other MSCs.

The diagram also includes queuing when there is no channel available. Calls for which handover had been initiated should be queued with priority higher than normal calls. They should have lower priority than emergency calls.

ii) Handover of calls within the area of MSC-A, i.e. handover cases i) and ii) (states 1, 2, 3 and 4). MSC-A controls the procedures on both the previous and the new radio channel. Both signals HA-INDICATION and HB-INDICATION are required. The handover procedure is completed when HB-CONFIRM is received. If this signal is not received, the radio path and the connection on interface B' are either released or the original connection is maintained depending on national choice.

The handover device is first set up so that all interfaces A', A" and B' are connected (illustrated by the signal set up handover device). This is done when HA-INDICATION is sent. The device is connected in its final position (i.e. A" to B' for case ii)) (illustrated by the signal connect handover device) either when HA-CONFIRM is received or when HB-CONFIRM is received.

iii) Handover to MSC-B (states 1, 2, 5, 6 and 7). This procedure is the one described in § 4.1.

address-complete signals are not supported. In such cases, an artificial address complete is established by functional unit 2.

Call clearing

The call clearing consists of two parts after inter MSC handover, clearing of the BS-MS connection and clearing of the inter MSC connection.

The MAP is used to transfer information between MSC-B and MSC-A in order to maintain full control with MSC-A. MSC-A determines, based on information received from MSC-B, the appropriate signals to be sent to the MS, and sends this information to MSC-B.

MSC-A shall initiate inter MSC connection release and send the end signal to release any resource attached to the call.

The clearing of the connection is by procedures relevant to the signalling system in the PSTN/ ISDN to which MSC-A is connected.

When the signalling system No. 7 - ISDN User Part is used, the normal symmetric release procedures apply on both the connection to the fixed network and to MSC-B.

When a signalling system is used with a symmetric release possibility, some notice should be given to the clear-forward and clear-back procedures.

For MS terminating calls the following conditions apply on clear- forward and clear-back:

- when a clear-forward signal is received on interface B' (see Figure 1/Q.1005), MSC-A clears the circuit to MSC-B by normal clear-forward procedures; and

- when a clear-back signal is received from MSC-B, MSC-A starts normal clear-back procedures towards the fixed network (interface B') and sends the clear-forward signal on interface B" in order to clear the connection with MSC-B.

  Note: This case corresponds to a fault situation. O&M actions are for further study.

For MS originated calls the following applies:

- when an MSC-A receives a clear-back signal from MSC-B, this signal must be interpreted as indicating clear-forward condition. MSC-A then clears both the connection on interface B' (see Figure 1/Q.1005) and to MSC-B by normal clear-forward procedures; and

  Note: This case corresponds to a fault situation. O&M actions are for further study.

- when MSC-A receives a clear-back signal on interface B',
  MSC-A should distinguish between national and international connections:

(recoup)

5.Detailed procedures in MSC-A

5.1BS/MSC (MS/BS) procedures MSC-A (functional unit 1)

The handover procedures in this functional unit consist of:

i) signalling between the MS and the MSC; and

ii) signalling between the BS and the MSC for

- initiation of quality measurements, and
- access management.

Signals sent to and received from functional unit 3 (handover control procedures MSC-A) are indicated in § 5.3 below.

5.2Call control procedures MSC-A (functional unit 2)

Related to handover the call control procedures in MSC-A can be divided into two functional entities.

The first entity is the call control procedure as part of the normal interworking between the PSTN/ISDN and the PLMN; for an MS originating call
MSC-A is the originating exchange, for an MS terminating call MSC-A is the destination exchange.

The second entity is the call control procedure for the connection between MSC-A and MSC-B in case of a handover from MSC-A to MSC-B. For the latter call control procedure the following applies.

Call set up

The connection to MSC-B is set up by procedures relevant to the signalling system used in the PSTN/ISDN to which MSC-A is connected. The call is set up by using the MS roaming number received from MSC-B as part of the MAP procedures.

The call set-up direction will always be from MSC-A to MSC-B, i.e. also when the call was originally established by the MS. Functional unit 2 should therefore keep information on call set-up direction in order to be able to correctly interpret any clearing signals (see below).

The unit should indicate the address-complete condition to functional unit 3 and through connect without waiting for the answer signal from MSC-B. This applies also to signalling systems where

FIGURE 7/Q.1005

Basic handover procedure

FIGURE 8/Q.1005

Subsequent handover procedure i):
successful handover from MSC-B to MSC-A

Insert Figure 6/Q.1005

4.3.2Subsequent handover procedure (optional)

4.3.2.1i)MSC-B to MSC-A

In addition to the subsequent handover procedure, described in § 4.21, this optional procedure is illustrated in Figure 8/Q.1005. When receiving the end signal, MSC-B sends the remove handover number message to its VLR and the handover completion message to MSC-A. MSC-A informs its VLR to send a roaming number to the HLR, after receiving the handover completion message.

4.3.3.2ii)MSC-B to MSC-B'

In addition to the subsequent handover procedure, described in § 4.2.2, this optional procedure is illustrated in Figure 9/Q.1005. After receiving the end signal, MSC-B releases the radio path and sends handover completion message to MSC-B'. MSC-B' informs its VLR to send a roaming number to the HLR, after receiving the handover completion message.

Note - Implementation of this procedure requires careful consideration of thehandling of some supplementary services (e.g., call waiting, conference calling or call commpletion to busy subscriber) at handover, since these aspects have not been studied in detail. The procedure is not included in the current version of the MAP (Recommendation Q.1051).

The procedure consists of two parts:

- subsequent handover as described in § 4.2.1 between MSC-A and MSC-B, and

- a basic handover procedure as described in § 4.1 between MSC-A and MSC-B'.

MSC-B sends the subsequent handover request message to MSC-A indicating a new MSC which is not MSC-A. The message contains the identity of MSC-B' and of the new BS. MSC-A then starts a basic handover procedure towards MSC-B'.

When MSC-A receives the ACM from MSC-B', MSC-A informs MSC-B that MSC-B' has started the handover procedure on the radio path by sending the subsequent handover acknowledgement message to MSC-B containing the new radio channel number. Now MSC-B can start the procedure on the radio path.

For MSC-A the handover is completed when it has received the successful handover message from MSC-B'. The connection between MSC-A and MSC-B is released by normal clearing procedures applicable for the PSTN/ISDN signalling system(s) on the connection between MSC-A and MSC-B. MSC-A also sends the end signal message to MSC-B in order to terminate the original handover procedure between MSC-A and MSC-B. Receiving this message, MSC-B releases the radio path.

In case no radio channel can be allocated in time or the connection between MSC-A and MSC-B' cannot be established, MSC-A informs MSC-B by a congestion message. MSC-B has then to maintain the existing connection with the MS as long as possible. When necessary, MSC-A sends the handover cancellation message to MSC-B'.

When the MS again passes the MSC boundary, MSC-B' is considered as an MSC-B so that the subsequent handover procedures given above are applicable for any series of handover between MSCs.

4.3 Handover procedure using subscriber information transfer (optional procedures)

This procedure is a handover procedure with subscriber information transfer during handover. To realize this handover procedure, only the following additional procedure will be needed.

4.3.1 Basic handover procedure (optional)

In addition to the basic handover procedure, described in § 4.1, this optional procedure is illustrated in Figure 7/Q.1005. MSC-A sends a handover completion message which contains subscriber information as soon as MSC-A receives the successful handover message. MSC-B informs its VLR to send a roaming number to the HLR to support supplementary services (e.g., call waiting), after receiving the handover completion message.

(recoup)

The procedure is as follows.

MSC-B sends the subsequent handover request message to MSC-A indicating that the new MSC is MSC-A. Because MSC-A is the call controlling MSC, this MSC needs no roaming number for routing purposes; MSC-A can directly search for a free radio channel at the desired BS.

When a radio channel can be assigned in time, MSC-A will return the subsequent handover acknowledgement message containing the new radio channel number and possibly other information to MSC-B. If a radio channel cannot be assigned, a no channel available indication will be given to MSC-B and MSC-B has to maintain the connection with the MS as long as possible.

If a radio channel has been reserved in MSC-A, both MSC-A and MSC-B can start the handover procedure on the radio path (in Figure 5/Q.1005 indicated by the interworking messages HB-INDICATION and HA-INDICATION respectively).

After handover, MSC-A has to release the connection with MSC-B by the procedures relevant to the PSTN/ISDN signalling system(s) used between MSC-A and MSC-B.

MSC-A must also terminate the MAP procedure for the basic handover between MSC-A and MSC-B. This is done by MSC-A by sending the end signal message to MSC-B. When receiving this signal, MSC-B sends the remove handover number message to its VLR.

4.2.2Description of the subsequent handover procedure ii) : MSC-B to MSC-B'

The procedure which takes place after the initiation procedure has indicated that the call has to be handed over to MSC-B' is shown in Figure 6/Q.1005 in the case of successful handover.

If the connection between MSC-A and MSC-B cannot be established (e.g. an unsuccessful backward message is received instead of the ACM), MSC-A terminates the procedure without clearing the radio path.

MSC-A will have the overall call control until the call is cleared by the fixed subscriber or the MS and there are no further call control functions to be performed (e.g. servicing waiting calls). MSC-A then releases the connection to MSC-B and also sends an end signal message which terminates the MAP procedure. When receiving this message MSC-B will release all call control functions and send the message remove handover number to its VLR.

MSC-A may terminate the procedure at any time by sending the MAP message handover cancellation to MSC-B. If establishment of the physical connection between MSC-A and MSC-B has been initiated, the physical connection must also be cleared by procedures defined for the signalling system used between MSC-A and the fixed network. The VLR of MSC-B is also informed by using the remove handover number message.

The handover cancellation message is sent when MSC-A detects clearing or interruption of the radio path before the call has been established on MSC-B. The message is also sent in order to terminate the MAP procedure in MSC-B when it is not possible to establish a connection between MSC-A and MSC-B.

4.2 Procedure for subsequent handover

When an MS, after the call has been handed over from MSC-A to MSC-B, leaves the area of MSC-B during the same call, subsequent handover is necessary in order to continue the connection.

The following cases are identified:

i) the MS moves back to the area of MSC-A, and

ii) the MS moves into the area of a third MSC (MSC-B').

In both cases the call is redirected in MSC-A using the handover device; the connection between MSC-A and MSC-B can be released after a successful subsequent handover has been performed.

4.2.1 Description of subsequent handover procedure i) : MSC-B to MSC-A

The procedure which takes place after the initiation procedure has indicated that a handover has to be made back to MSC-A is shown in Figure 5/Q.1005 for the case of successful handover.

If there is no free traffic channel in MSC-B, this will be indicated to MSC-A and MSC-A will terminate the handover procedure. The existing connection to the MS will not be cleared.

At this point, MSC-A establishes a connection between MSC-A and MSC-B by signalling procedures supported by the network to which MSC-A is connected. In Figure 4/Q.1005 this is illustrated by the messages IAM (Initial Address Message) and the ACM (Address Complete Message) of Signalling System No. 7. MSC-B initiates the handover procedure on the radio path when the ACM is sent and MSC-B initiates the procedure when the ACM is received (illustrated by HB-and HA-INDICATION, respectively).

The connection is through-connected in MSC-A by use of a handover device. The through-connection is done and the old radio channel is released when MSC-A receives an acknowledgement from the MS (HA-CONFIRM) or when the successful handover message is received from MSC-B. MSC-B sends this message when it receives an acknowledgement from the MS (HB-CONFIRM).

In order not to conflict with the PSTN/ISDN signalling system(s) used between MSC-A and MSC-B, MSC-B must generate an answer signal when HB-CONFIRM is received.

5.The switch MSC-B for connecting the circuit from MSC-A (interface B") to the circuit to the BS (interface A").

MSC-B will also require a handover device for subsequent handovers to BSs (or to another channel of the same BS) in the MSC area of MSC-B. Subsequent handovers to other MSCs will not require switching in MSC-B (see below).

3.Initiation

The decision that a handover shall take place can be made by both the MS and the BS by monitoring the channel quality. If the decision is made by the MS, a handover request message should be provided to the BS.

Depending on the radio sub-system arrangement the new BS, to which the call is to be handed over, can either be determined by the MS or the MSC. If determined by the MS, the indication of the BS candidates will be providing to the MSC by signalling on the radio path.

If the new BS is to be determined by the MSC, this may require measurements on its own BSs and BSs in other MSCs. Procedures defined in Recommendation Q.1051 are used for initiating measurements on BSs in other MSCs.

The initiation procedures are for further study.

4.General description of the procedures for handover to another MSC

4.1Basic handover procedure

The procedure which takes place after initiation, i.e. after the identity of the new BS has been determined, is shown in Figure 4/Q.1005 for a successful handover. The procedure makes use of messages of the Mobile Application Part (MAP) of Recommendation Q.1051.

Firstly, MSC-A sends a radio channel request message to MSC-B. The message will contain all parameters needed by MSC-B for allocating a radio channel (see Recommendation Q.1051). The message will also identify the BS to which the call is to be handed over. MSC-B will return the radio channel acknowledge message after having received the mobile station roaming number from its VLR (exchange of the messages request for handover number and handover number acknowledge). The roaming number is to be used for routing the call from MSC-A to MSC-B. If a traffic channel is available in MSC-B the radio channel acknowledge message will contain the identity of the new radio channel and the mobile station roaming number. Other parameters may also be included (see Recommendation Q.1051).

Figure 2a)/Q.1005	A' to B'	A" to B'
Figure 2b)/Q.1005	A' to B'	B' to B"
Figure 2c)/Q.1005	B' to B'	B' to B"'

2.2MSC-B

The functional composition of an MSC acting as MSC-B is essentially the same as that of MSC-A. However, there are some differences. The functional units are as follows (see Figure 3/ Q.1005).

Signalling functions

1.The BS/MSC (MS/BS) procedures MSC-B for signalling between the MSC and the new BS and between the MSC and the MS (interface A").

(recoup)

(recoup)

2.The call control procedures MSC-B for normal call control functions and for signalling between MSC-A and MSC-B.

3.The handover control procedures MSC-B for control of the handover in MSC-B.

4.The MAP procedures MSC-B for information exchange with MSC-A and the VLR of MSC-B.

Switching functions

(to the previous BS) and, for case ii), also through interface A" (to the new BS). Interworking with other functional units takes place through the internal interface x.

2.The call control procedures MSC-A for normal call control functions (interface B') and for signalling and call control of connections to other MSCs (interfaces B" and B'"). Interfaces B" and B'" apply only to handover cases iii) and iv) where interface B'" is required for subsequent handover.

3.The handover control procedures MSC-A for overall control of the handover including interworking with other functional units (interfaces x, y and z).

(recoup)

4.The MAP procedures MSC-A for information exchange with other MSCs and location registers. This function is required for handover cases iii) and iv). The external interface is interface c and the internal interface to the handover control functions is interface z. Interface C represents the interface to all entities with which MSC-A is communicating during handover (other MSCs, location registers).

Note - This functional unit may also be required for cases i) and ii) if measurements have to be performed in other MSCs for determining the new BS (see below).

Switching functions

5.The switch and handover device MSC-A for connecting the new path. This function is additional to normal switching functions in the MSC. The handover device has interfaces to the previous BS (interface A') and the new BS (interface A") for handover case ii). Interface B' represents the original connection with the fixed network and interface B" represents the new connection to and MSC-B for handover between MSCs (cases iii) and iv)). Interface B'" represents the connection to a third MSC (MSC-B') for subsequent handover from MSC-B to MSC-B'. The connections which can exist in the handover device are shown in Figure 2/ Q.1005.

The connection via interface A' is released after completion of a successful handover (Figures 2a and 2b/Q.1005).

For MS to MS calls in the same MSC the configuration in Figure 2b/Q.1005 applies. Then interface B" is not to another MSC but internal to MSC-A.

Case	Initial connection	Resulting connection

ii) handover between base stations of the same MSC in order to ensure continuity of the connection when an MS moves from one BS area to another;

iii) handover between base stations of different MSCs of the same PLMN; and

iv) handover between base stations of MSCs in different PLMNs.

The same procedures can be used on the radio path for all four cases.

Cases i) and ii) involve only one MSC.

Note - Depending on the handover criteria, case ii) may involve measurements in other MSCs.

Cases iii) and iv) involve more than one MSC. For these cases, two procedures are defined requiring the use of the mobile application part:

a) basic handover procedure where the call is handed over from the controlling MSC (MSC-A) to another MSC (MSC-B); and

b) subsequent handover procedure where the call is handed over from MSC-B to MSC-A or from MSC-B to a third MSC (MSC-B').

In most respects case iv) is similar to case iii). However, any additional aspects of case iv) not covered by the specification of case iii) will not be included in this Recommendation for the time being.

The procedures in the mobile application part for supporting handover are specified in Recommendation Q.1051.

In the following, the controlling MSC will be referred to as MSC-A also when the handover only involves this MSC (cases i) and ii) above). For cases iii) and iv), the controlling MSC (MSC-A) is the MSC on which the call was originally established.

All MSCs should be capable of acting as MSC-A and MSC-B.

2.Functional composition of MSCs and interfaces for handover

2.1MSC-A

For handover the controlling MSC can be regarded as being composed of functional units as shown in Figure 1/Q.1005.

Signalling functions

1.The BS/MSC (MS/BS) procedures MSC-A for signalling between the MSC and the BS and between the MSC and the MS. The functional unit interfaces the BSs through interfaces A'

Recommendation Q.1005

HANDOVER PROCEDURES

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Recommendation Q.1005

HANDOVER PROCEDURES

1.Introduction

This Recommendation contains a detailed description of handover procedures to be used in PLMNs.

The following cases are considered:

i) handover between radio channels of the same base station;
Note: This capability is mandatory and could be used in the following situations:

- when the radio channel carrying the call is subject to interference or other disturbances, and/or

- when a radio channel or channel equipment carrying a call has to be taken out of service for maintenance or other reasons;