

TS 101 252 V5.2.0 (1998-01)

Technical Specification

**Digital cellular telecommunications system (Phase 2+);
Description for the use of a Shared Inter Working Function
(SIWF) in a GSM PLMN;
Stage 2
(GSM 03.54 version 5.2.0)**



GSM®
GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS



European Telecommunications Standards Institute

Reference

RTS/SMG-040354QR1 (blc02io3.PDF)

Keywords

Digital cellular telecommunications system,
Global System for Mobile communications (GSM)***ETSI Secretariat***

Postal address

F-06921 Sophia Antipolis Cedex - FRANCE

Office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16
Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

X.400

c= fr; a=atlas; p=etsi; s=secretariat

Internet

secretariat@etsi.fr
<http://www.etsi.fr>

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

Contents

Intellectual Property Rights.....	5
Foreword	5
1 Scope.....	6
2 Normative references	6
3 Definitions and Abbreviations	7
3.1 Definitions	7
3.2 Abbreviations.....	7
4 Architecture.....	7
4.1 General.....	7
4.2 Routeing principles	8
4.3 Visited MSC with additional SIWF functionality (SIWFC)	9
4.4 SIWFS - Shared Inter Working Function Server	10
4.4.1 General.....	10
4.4.2 IWU.....	11
4.4.3 Data call Routeing Mechanism (DRM).....	11
4.5 K Interface and Signalling	11
4.6 Fixed Network	11
5 Procedures.....	11
5.1 General.....	11
5.2 Mobile Originated calls	12
5.2.1 Call flow MOC (Loop Method)	14
5.2.2 Call flow for MOC (Non Loop Method).....	15
5.3 Mobile Terminated calls	15
5.3.1 Call flow for MTC (Loop Method)	17
5.3.2 Call Flow for MTC (Non-Loop Method)	17
5.4 In Call Modification (ICM)	17
5.4.1 Call in Data/Fax Mode	18
5.4.2 Call in Speech Mode	18
5.4.3 Call Flow for ICM Procedure.....	20
5.5 Modifications in a connection.....	20
5.5.1 Channel Mode Modify (CMM)	20
5.5.2 User initiated resource up- and down grading.....	21
5.5.3 Network Resource up- and downgrading	21
5.6 Release.....	22
5.7 Negotiation of parameters.....	22
5.8 Inter MSC handover.....	22
5.9 Reset	22
6 SIWF and Supplementary Services.....	22
6.1 Number Identification Supplementary Services.....	23
6.2 Call Offering Supplementary Services.....	23
6.3 Call Waiting (CW).....	23
6.4 Closed User Group (CUG)	23
6.5 User-to-User Supplementary Services	23
6.6 Charging Supplementary Services	23
6.7 Call Restrictions.....	23
6.8 Support of Private Numbering Plan (SPNP).....	23
6.9 Call Completion on Busy Subscriber (CCBS)	23

7 Interaction with CAMEL23

8 Operation and Maintenance Aspects23

9 Charging24

10 Interception24

History25

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETR 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available **free of charge** from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<http://www.etsi.fr/ipr>).

Pursuant to the ETSI Interim IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETR 314 (or the updates on <http://www.etsi.fr/ipr>) which are, or may be, or may become, essential to the present document.

Foreword

This ETSI Technical Specification (TS) has been produced by the Special Mobile Group (SMG) of the European Telecommunications Standards Institute (ETSI).

This TS defines the stage 2 for the introduction of a Shared Inter Working Function in a GSM Public Land Mobile Network.

The contents of this TS are subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of this TS, it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

Version 5.x.y

where:

- y the third digit is incremented when editorial only changes have been incorporated in the specification;
- x the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

1 Scope

This Technical Specification (TS) defines the stage two description of the Shared Inter Working Function (SIWF) on Global System for Mobile communications (GSM).

A stage one description does not exist because this service is not visible to the service subscribers and users. This stage two identifies the functional Capabilities and information flows needed to support the service. The signalling system protocols and switching functions needed to implement this service are defined in the relevant specifications.

Interworking with other networks (e.g. PSTN) needs the presence of specific functions associated with the MSC, known as interworking functions (IWF). The IWFs depend on the type of network with which it is desired to interconnect and the type of service desired.

A Shared Inter Working Function is a network function that may be used by any MSC in the same PLMN to provide interworking for a data/fax call. Whereas an IWF can only be used by its MSC, the SIWF can be used by several other network nodes e.g. any MSC within the same PLMN (the concept is not limited to a certain number of MSCs). SIWF is applied to data services in GSM Phase 2 and GSM Phase 2+ (as defined in GSM 02.02, GSM 02.03 and GSM 02.34).

The usage of a SIWF requires no additional manipulation at the MS.

There is an interest to have a Shared Interworking Function (SIWF) for the following reasons:

- possibility to fabricate/obtain the specific functionality needed for data services in areas where data traffic is expected to be low,
- handling of data calls in case of local overload of the data traffic,
- quick introduction and roll-out of new data services.

2 Normative references

This TS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this TS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

- [1] GSM 01.04 (ETR 350): "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".
- [2] GSM 02.02 (ETS 300 904): "Digital cellular telecommunications system (Phase 2+); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".
- [3] GSM 02.03 (ETS 300 905): "Digital cellular telecommunications system (Phase 2+); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".
- [4] GSM 02.04 (ETS 300 918): "Digital cellular telecommunications system (Phase 2+); General on supplementary services".
- [5] GSM 02.33: "Digital cellular telecommunication system (Phase 2+); Lawful interception - Stage 1".
- [6] GSM 02.34: "Digital cellular telecommunication system (Phase 2+); High Speed Circuit Switched Data (HSCSD) - Stage 1".
- [8] GSM 03.34 (TS 101 038): "Digital cellular telecommunication system (Phase 2+); High Speed Circuit Switched Data (HSCSD); Stage 2 Service Description".
- [9] GSM 03.45 (ETS 300 931): "Digital cellular telecommunications system; Technical realization of facsimile group 3 transparent".
- [10] GSM 07.01 (ETS 300 913): "Digital cellular telecommunications system (Phase 2+); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

- [11] GSM 09.05: "Digital cellular telecommunications system; Interworking between the Public Land Mobile Network (PLMN) and the Packet Switched Public Data Network (PSPDN) for Packet Assembly/Disassembly facility access (PAD)".
- [12] GSM 09.06 (ETS 300 975): "Digital cellular telecommunications system (Phase 2+); Interworking between a Public Land Mobile Network (PLMN) and a Packet Switched Public Data Network/Integrated Services Digital Network (PSPDN/ISDN) for the support of packet switched data transmission services".
- [13] GSM 09.07 (ETS 300 976): "Digital cellular telecommunications system (Phase 2+); General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".
- [14] ETS 300 102-1: "Integrated Services Digital Network (ISDN); User-network interface layer 3 Specifications for basic call control".

3 Definitions and Abbreviations

3.1 Definitions

For the purposes of the present document, the following definitions apply:

- Visited MSC The MSC which is responsible for handling calls involving the mobile. In the description of inter-MSC handover in GSM 03.09 this is the MSC referred to as "MSC-A" (controlling MSC).
- K Interface The interface between the visited MSC and an SIWFS.

3.2 Abbreviations

For the purposes of the present document, the the following abbreviations apply:

- CD Call Direction.
- CDo Call Direction at Call Set-up.
- CDm Call Direction modify.
- DRM Data call Routeing Mechanism
- IWF Inter Working Function
- IWU Inter Working Unit.
- MSC/SIWFS An MSC with an implemented SIWF Server.
- SIWF Shared Interworking Function.
- SIWFC Shared Inter Working Function Controller. Additional functionality in the visited MSC for the support of SIWFS.
- SIWFS SIWF Server. SIWFS is the entity where the used IWU is located.

Other abbreviations used in this specification are listed in GSM 01.04.

4 Architecture

4.1 General

An IWF provides specific functions associated with the visited MSC for the interworking with other networks. It comprises signalling and traffic channel related functions. The traffic channel related functions are provided by an Inter Working Unit (IWU).

The SIWF concept is that it provides specific functions for the interworking with other networks. It comprises signalling and traffic channel related functions. Whereas the signalling related functions are associated with the visited MSC, the IWU providing the traffic channel related functions has another physical location.

The entity that contains all additional functions needed in the visited MSC to provide the SIWF is called SIWF Controller (SIWFC). The entity where the IWU is located is called SIWF Server (SIWFS). The Interface between a visited MSC and a SIWFS is called the K Interface.

SIWFS can be provided by a MSC (MSC/SIWFS) or by another network entity (stand alone SIWFS).

Figure 1 shows the network configuration.

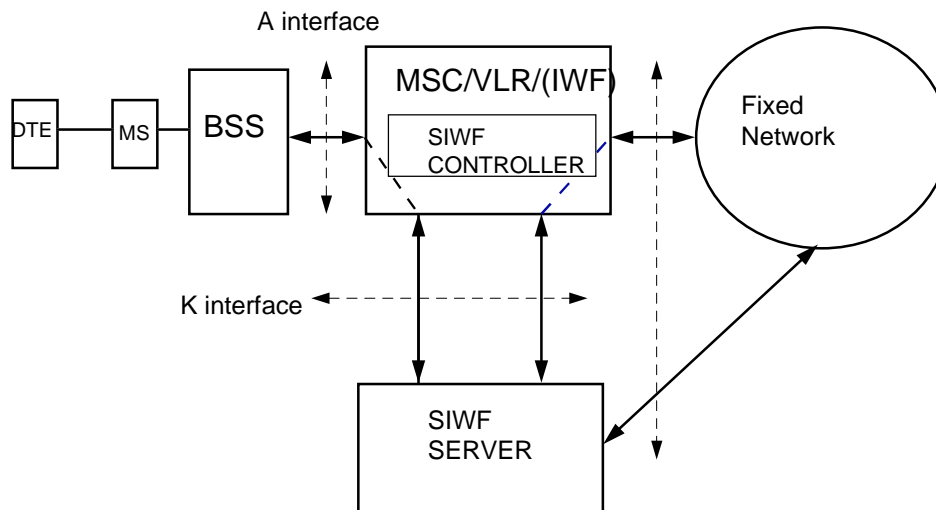


Figure 1. Network configuration

4.2 Routing principles

The call is routed according to the following principles:

- a loop i.e. DTE - MS - BSS - visited MSC - SIWF Server - visited MSC - Fixed network. This is applicable for both mobile originating or mobile terminating calls. This is called the Loop Method. (Figure 2)
- a non-loop i.e. DTE - MS - BSS - visited MSC - SIWF Server - Fixed network. This is only applicable for mobile originating calls. This is called the Non Loop Method. (Figure 3).

The signalling link between the MSC with SIWFC and the SIWFS is used for normal circuit switched signalling and for conveying additional controlling information via MAP signalling.

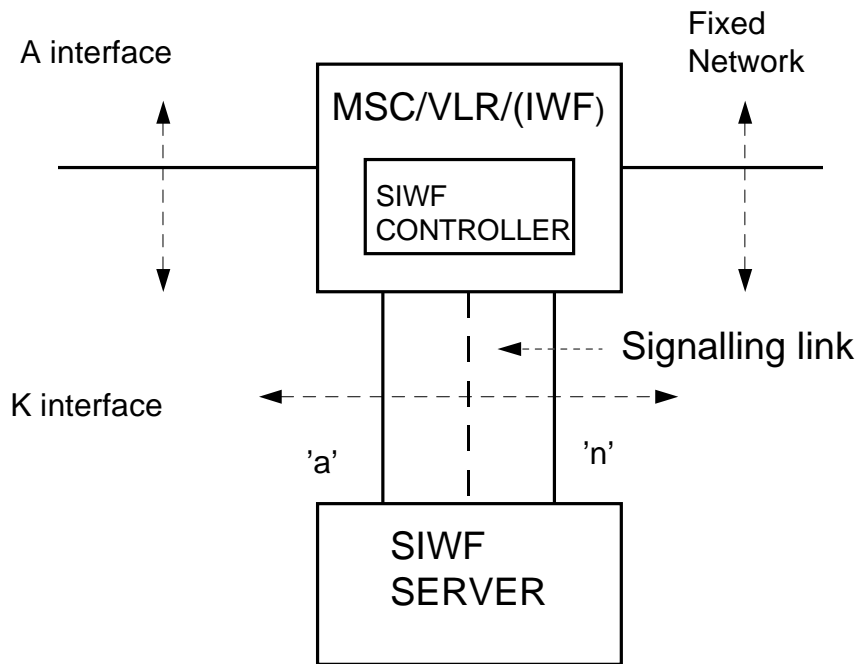


Figure 2: The Loop Method. The traffic circuits 'a' and 'n', where 'a' is used to send and receive data between MS and SIWF Server and 'n' is used to send and receive data of the fixed network

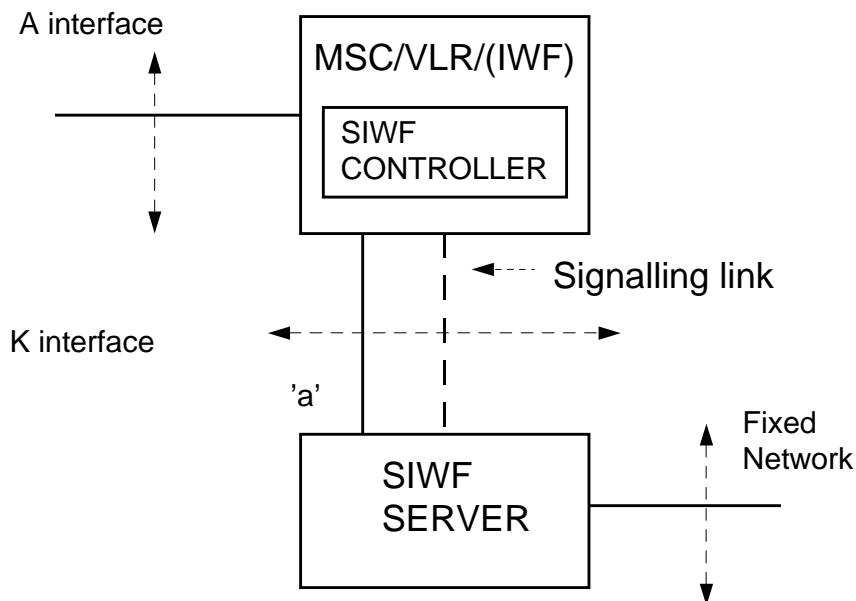


Figure 3: The Non Loop Method. The traffic circuit 'a' is used to send and receive data between MS and SIWF Server

4.3 Visited MSC with additional SIWF functionality (SIWFC)

The visited MSC is responsible for allocation of an IWF or a SIWFS. In the case the visited MSC has the additional functions required to provide a SIWF, this additional functionality in the visited MSC is called SIWFC. SIWFC is a logical part of the MSC.

The visited MSC examines IWF Capabilities based on the service request and available resources. The visited MSC comprises of functions for selection of an appropriate SIWFS and the allocation of the traffic channels depending on the SIWF type. In addition to the GSM phase 2 MSC responsibility, the visited MSC including SIWFC is responsible for:

- The analysis for the selection of an appropriate SIWFS is based on the contents in the information received during call set-up. For this purpose the Visited MSC has the knowledge of routeing information to SIWFS and the service Capabilities on each SIWFS.
- In addition the operator may specify conditions for redirection.
- The examination results in that either the MSC/IWF is used (if such exist) or that the call is redirected to a SIWFS.
- In case the analysis results in that the call shall be routed to a SIWFS, the visited MSC allocate 'a'- circuits for mobile originating calls and 'n' circuits for mobile terminating calls to be used between the MSC and the SIWFS, and establishing a connection to the SIWFS.
- The MSC determines via the signalling to the SIWFS, how the call shall be routed i. e. either back to the visited MSC (loop method) or to the final destination (non loop method). This indication is sent in a MAP Procedure.
- By-passing the SIWFS connection in the Speech part of Alternate services.

The visited MSC may or may not contain an IWF.

4.4 SIWFS - Shared Inter Working Function Server

4.4.1 General

The logical entity that contains the IWU is called SIWF Server (SIWFS). It offers IWU to remotely located MSCs. The IWU provides the traffic channel related functions. SIWFS contains also the DRM which is needed for the additional signalling between entities involved i.e. the visited MSC and the SIWFS. See figure 4.

SIWFS is responsible for:

- allocation of 'n'-circuit for mobile originating calls and 'a'-circuit for mobile terminating calls to be used to the MSC.
- signalling interworking to ISDN, PSTN and (PS)PDN, allocation of resources towards the fixed network in case the non Loop Method is used.

An operator can decide to concentrate all the data/fax traffic to one specific SIWFS.

The physical location of the SIWFS can be an MSC or in another network entity. In the case the SIWFS is implemented in an MSC it is denominated MSC/SIWFS.

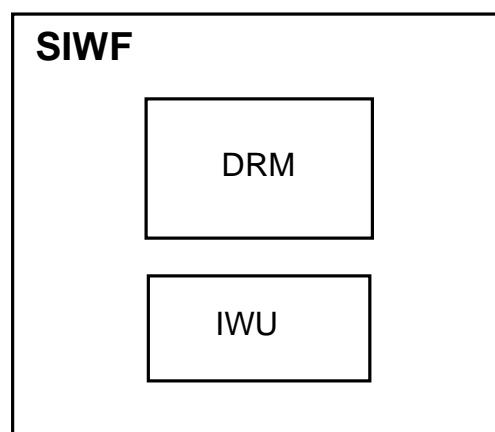


Figure 4: The logical entity SIWFS

4.4.2 IWU

The IWUs in SIWFS have the same functions as the existing IWFs. The responsibility by the IWU concerns the traffic handling functions e.g.

- Interworking between the rate adapted A interface frames carrying the user data and the signals on the fixed network circuits.
- Data interworking in the transparent and non transparent mode e.g. modems, V.110 frames, RLP, the handling of fax protocol and handling of network based datacompression.

4.4.3 Data call Routeing Mechanism (DRM)

The DRM is a logical function which supports the handling of calls in SIWFS.

DRM is used for examination of service request and available resources for the support of data/fax call in SIWFS. The examination results in that either the call is accepted and that the IWU is connected or that the call is rejected.

The DRM receives information whether the call is to be routed in a Loop (back to the visited MSC) or as Non Loop (directly to the final destination) via the signalling from the visited MSC. The SIWFS shall have routeing capabilities but it has no own routeing alternatives.

4.5 K Interface and Signalling

The link between the visited MSC and the SIWFS supports signalling functions and functions for the transport of traffic. In addition the link supports signalling functions to control the SIWFS i.e. IWU located in the selected SIWFS.

The traffic channel supports that a circuit will be used to send and receive data in the A interface format and will be called 'a' circuit. Another circuit will be used to send and receive data in the format of the fixed network and will be called 'n' circuit. The circuits 'a' and 'n' consist of one 64kbps channel each.

The signalling channel supports e. g. ISUP i.e. the signalling between the visited MSC and the SIWFS by using e. g. ISUP. The checking and the mapping of information element parameters of the GSM 04.08 signalling take place in the visited MSC in accordance with GSM 09.07.

The signalling on the K Interface requires additional controlling signalling. This signalling is handled by a MAP procedure. The MAP Procedures supports at least submission of all GSM-BC, all ISDN-BC (09.07), A-Number, B-Number and CMM. The MAP Dialogue is open throughout the call.

4.6 Fixed Network

Fixed network can be any network with which GSM PLMN is interworking for data services. Requirements on fixed networks are outside the scope of this specification.

5 Procedures

5.1 General

A visited MSC uses its capabilities to direct data/fax calls to a SIWFS. This is applicable for both mobile originating and mobile terminating data calls. A loop method is used, where the data traffic is redirected from the visited MSC to the SIWFS, adapted, and then re-routed back to the visited MSC for routeing to the final destination.

Mobile originated calls can also use a non-loop method i.e. the calls can be routed directly from the SIWFS to the final destination.

Transit traffic through an SIWFS to another SIWFS is not allowed.

The call flows in chapter 5 are all examples based on ISUP/MAP signalling. The general principle by conveying all GSM-BC, converted ISDN BC (from GSM-BC), Call Direction (CD) and associated information like HLC and LLC (not showed in the call flows) by MAP procedures from the visited MSC to the SIWFS, result in that also less intelligent signalling protocol than ISUP can be used between the visited MSC and the SIWFS e. g. TUP. The general principle result in that ISUP (or TUP) is simple used for the handling of the required PCM channels between the visited MSC and the SIWFS.

5.2 Mobile Originated calls

This subclause describes the procedure used to establish a connection to the SIWFS for a Mobile Originated call.

Mobile originated calls shall follow the normal call set-up procedures. No additional manipulation at the **MS** is needed.

If the **visited MSC** decides to use an SIWF it uses its SIWFC to route the call towards an SIWFS. This includes:

- selection of an appropriate SIWFS.
- sending a request to the SIWFS.
- waiting for an acknowledgement from the SIWFS.
- routing the call to the SIWFS and allocating an 'a' -circuit to this entity.

The SIWFS can be accessed after the negotiation of the GSM BC parameters and the allocation of radio resources in the visited MSC. The visited MSC decides the selection of a SIWFS after the ASSIGNMENT COMPLETE has been received. The selection of an appropriate SIWFS or MSC/IWF is based

- on the relevant parameters in the signalling messages (SETUP, CALL PROCEED and ASSIGNMENT COMPLETE),
- on status information from IWF and SIWFS (e.g. IWU busy or congested, IWU out of order, etc.) together with normal route supervision and
- on further criteria's that can be determined by the operator (e.g. conditions for routing).

The visited MSC allocate a temporary V-MSC address (V-MSC-Addr) similar to MSRN (E.164 number). This address will be used by the visited MSC to correlate the incoming IAM messages from SIWFS. The visited MSC sends a request to the selected SIWFS by means of a MAP_Provide_SIWFS_Number procedure. The MAP_Provide_SIWFS_Number procedure contains all information needed for the SIWFS to evaluate the requirement and to select and to seizure an appropriate IWU. In particular, these information are

- V-MSC-Addr/B-SubscrAddr: The address (an E.164 number) where the SIWFS has to route the call. In the case of the loop method it is the address of the visited MSC and in the case of the non-loop method it is the address of the B-subscriber.
- GSM-BC': The GSM-BC negotiated with the MS.
- ISDN-BCn: The ISDN-BC mapped from the GSM-BC'. It is used by the SIWFS to route the call and to allocate an 'n'-circuit (loop method) or a traffic channel towards the fixed network (non-loop method).
- CD: Call Direction to indicate the direction at call set-up (MOC/MTC)
- Chosen Channel: The Chosen Channel specifies the assigned radio channel.

The visited MSC waits for the acknowledgement MAP_Provide_SIWFS_Number_Ack.

The **SIWFS** assigns and returns a temporary SIWFS address (similar to MSRN), an E.164 number. This address will be used by the visited MSC to route the call, i.e. the IAM to the SIWFS and it will be used by the SIWFS to correlate the incoming IAM to the corresponding MAP message MAP_Provide_SIWFS_Number (i.e. Call Reference).

The SIWFS sends the acknowledgement MAP_Provide_SIWFS_Number_Ack back to the visited MSC.

If the acknowledgement is negative (possibly indicated via the MAP procedure), the **visited MSC** may release the call or it may select an alternative SIWFS. The number of routeing alternatives is an implementation issue and not a part of this specification.

If the acknowledgement is positive, the visited MSC will set-up an 'a' circuit towards the SIWFS. For that it uses an appropriate ISDN-BCa and the transmission medium requirements set to „64 kbit/s unrestricted“.

If no valid response is received in the ISUP-signalling the visited MSC may select an alternative route to the same SIWFS, release the call or it may select an alternative SIWFS. The number of routeing alternatives is an implementation issue and not a part of this specification.

Normal ISUP signalling follows.

The **SIWFS** routes the call to the address that it has got from the visited MSC. In the case of the loop method it is the address of the visited MSC and in the case of the non-loop method it is the address of the B-subscriber. These addresses are conveyed as parameter in the message MAP_Provide_SIWFS_Number. So, the SIWFS routes the call to the visited MSC and allocates an 'n'-circuit towards the visited MSC in the case of the loop method or it routes the call directly towards the fixed network. If the call routeing is not possible it releases the call by ISUP means.

Hence, the selection of the loop or non-loop method

- is transparent for the SIWFS and
- is controlled by the visited MSC by providing the appropriate address to the SIWFS.

In case the non loop method is used for dedicated PAD or dedicated Packet Access (BS4x or BS5x) calls, the call proceeds in accordance with GSM 09.05 or GSM 09.06. Acknowledgement is sent to the visited MSC. Acknowledgement and Answer for the call may have to be generated by the SIWFS.

There is one restriction:

- Dual services are only supported together with the loop method.

Normal ISUP signalling follows. When the SIWFS receives the ISUP Answer message it activates the IWU.

In the case of a dual service the SIWFS will be selected and activated either if the first GSM-BC does not indicate speech or if in speech position and an in-call modification is ordered by the MS.

5.2.1 Call flow MOC (Loop Method)

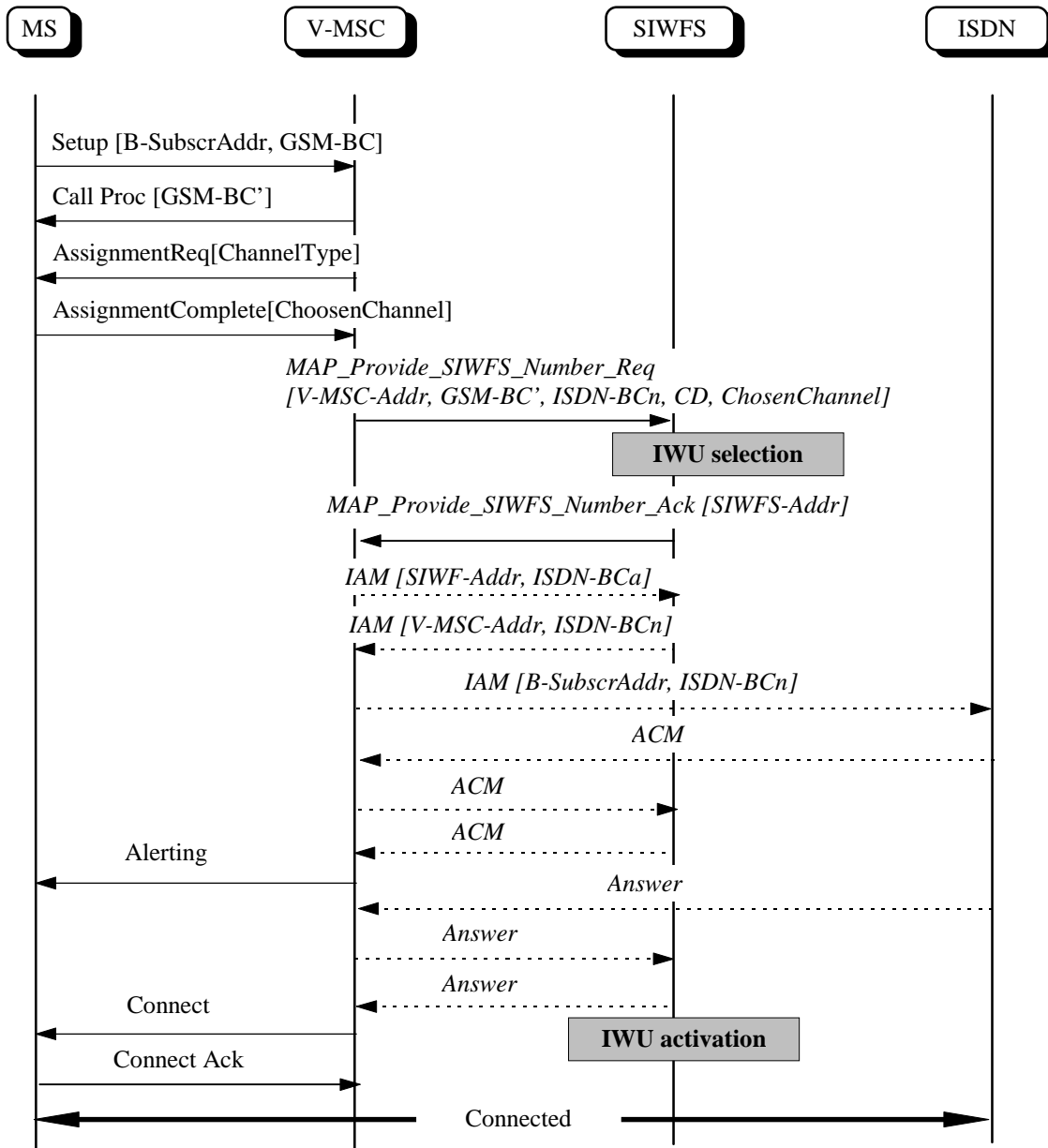


Figure 5: Call flow for MOC in the case of the loop method

5.2.2 Call flow for MOC (Non Loop Method)

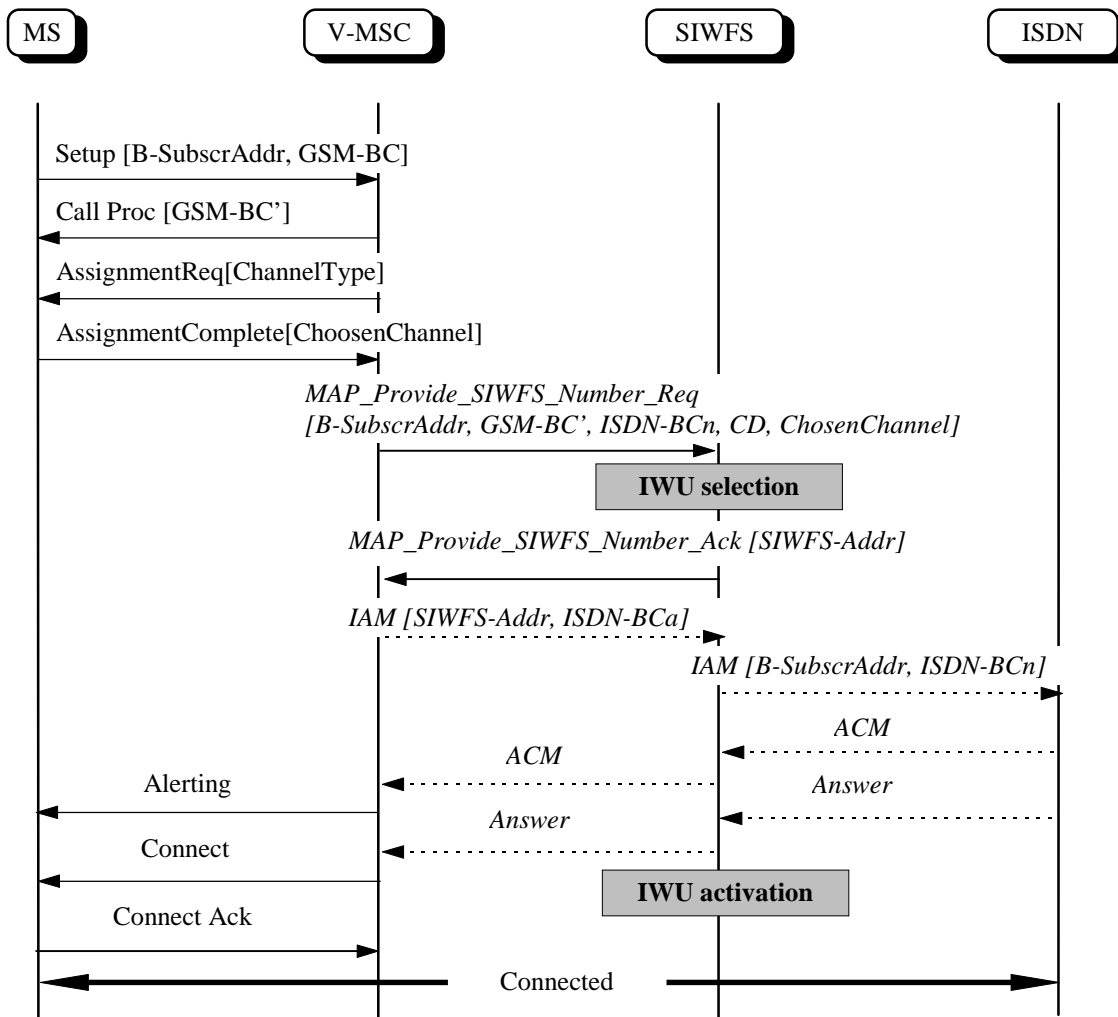


Figure 6: Call flow for MOC in the case of the non-loop method

NOTE: In some PAD or PH interworking schemes (defined in GSM 09.05 and 09.06), the ISUP signals between SIWFS and ISDN are not used for Dedicated Services (Bearer Services 4x and 5x). In this case ACM and Answer have to be generated by SIWFS towards the visited MSC.

5.3 Mobile Terminated calls

This subclause describes the procedure used to establish a connection to the SIWFS for a Mobile Terminated call.

For MTC, the routing is based either on associated information to call set-up (PSTN case) or contents in IAM. GMSC interrogates HLR for roaming number and HLR interrogate VLR due to the B-number. The VLR provides the MSRN in accordance with normal procedures. See GSM 09.07.

If the **visited MSC** decides to use an SIWF it uses its SIWFC to route the call towards an SIWFS. This includes:

- selection of an appropriate SIWFS;
- sending a request to the SIWFS;
- waiting for an acknowledgement from the SIWFS;
- routing the call to the SIWFS and allocating an 'n' -circuit to this entity.

The SIWFS can be accessed after the negotiation of the GSM BC parameters and the allocation of radio resources in the visited MSC. The visited MSC decides the selection of a SIWFS after the ASSIGNMENT COMPLETE has been

received. The usage of single or mult numbering scheme will not result in different handling of the Mobile Terminating call as the selection of the SIWFS only can be made after this procedure. The selection of an appropriate SIWFS or MSC/IWF is based

- on the relevant parameters in the signalling messages (IAM, CALL CONFIRMED and ASSIGNMENT COMPLETE);
- on status information from IWF and SIWFS together with normal route supervision.

The visited MSC allocates a temporary V-MSC address (V-MSC-Addr) similar to MSRN (E.164 number). This address will be used by the visited MSC to correlate the incoming IAM messages from SIWFS. The visited MSC sends a request to the selected SIWFS by means of a MAP_Provide_SIWFS_Number procedure. The MAP_Provide_SIWFS_Number procedure contains all information needed for the SIWFS to evaluate the requirement and to select and to seize an appropriate IWU. In particular, these information are

- V-MSC-Addr: The address, an E.164 number, where the SIWFS has to route the call i.e. the address of the visited MSC.
- GSM-BC': The GSM-BC negotiated with the MS.
- ISDN-BCn: The ISDN-BC received from the fixed network. The ISDN-BCa used to allocate an 'a'-circuit to the visited MSC will be generated internally by using the ISDN-BCn.
- CD: Call Direction to indicate the direction at call set-up (MOC/MTC)
- Chosen Channel: The Chosen Channel specifies the assigned radio channel.

The visited MSC waits for the acknowledgement MAP_Provide_SIWFS_Number_Ack.

The **SIWFS** assigns and returns a temporary SIWFS address (similar to MSRN), an E.164 number. This address will be used by the visited MSC to route the call, i.e. the IAM to the SIWFS and it will be used by the SIWFS to correlate the incoming IAM to the corresponding MAP message - MAP_Provide_SIWFS_Number (i.e. Call Reference).

The SIWFS sends the acknowledgement MAP_Provide_SIWFS_Number_Ack back to the visited MSC.

If the acknowledgement is negative (possibly indicated via the MAP procedure), the **visited MSC** may release the call or it may select an alternative SIWFS. The number of routing alternatives is an implementation issue and not a part of this specification.

If the acknowledgement is positive, the visited MSC will set-up an 'n' circuit towards the SIWFS. For that it uses the ISDN-BCn received from the fixed network.

If no valid response is received in the ISUP-signalling the visited MSC may select an alternative route to the same SIWFS, release the call or it may select an alternative SIWFS. The number of routing alternatives is an implementation issue and not a part of this specification.

The **SIWFS** routes the call to the address that it has got from the visited MSC, i.e. the address of the visited MSC. This address is conveyed as parameter in the message MAP_Provide_SIWFS_Number. So, the SIWFS routes the call to the visited MSC and allocates an 'a'-circuit towards the visited MSC. For that it uses an appropriate ISDN-BCa with the transmission medium requirements set to "64 kbit/s unrestricted". If the call routing is not possible it releases the call by ISUP means.

Normal ISUP signalling follows.

Note that the signals ALERT and CONNECT are independent of the ISUP signalling between V-MSC and SIWFS. In the case that these signals are received from the MS before IAM is received from SIWFS, the V-MSC withholds the signals until IAM from SIWFS is received before sending ANSWER to SIWFS.

When the SIWFS receives the ISUP Answer message it activates the IWU.

In the case of a dual service, the SIWFS will be selected and activated either if the first GSM-BC does not indicate speech or if in speech position and an in-call modification is ordered by the MS.

5.3.1 Call flow for MTC (Loop Method)

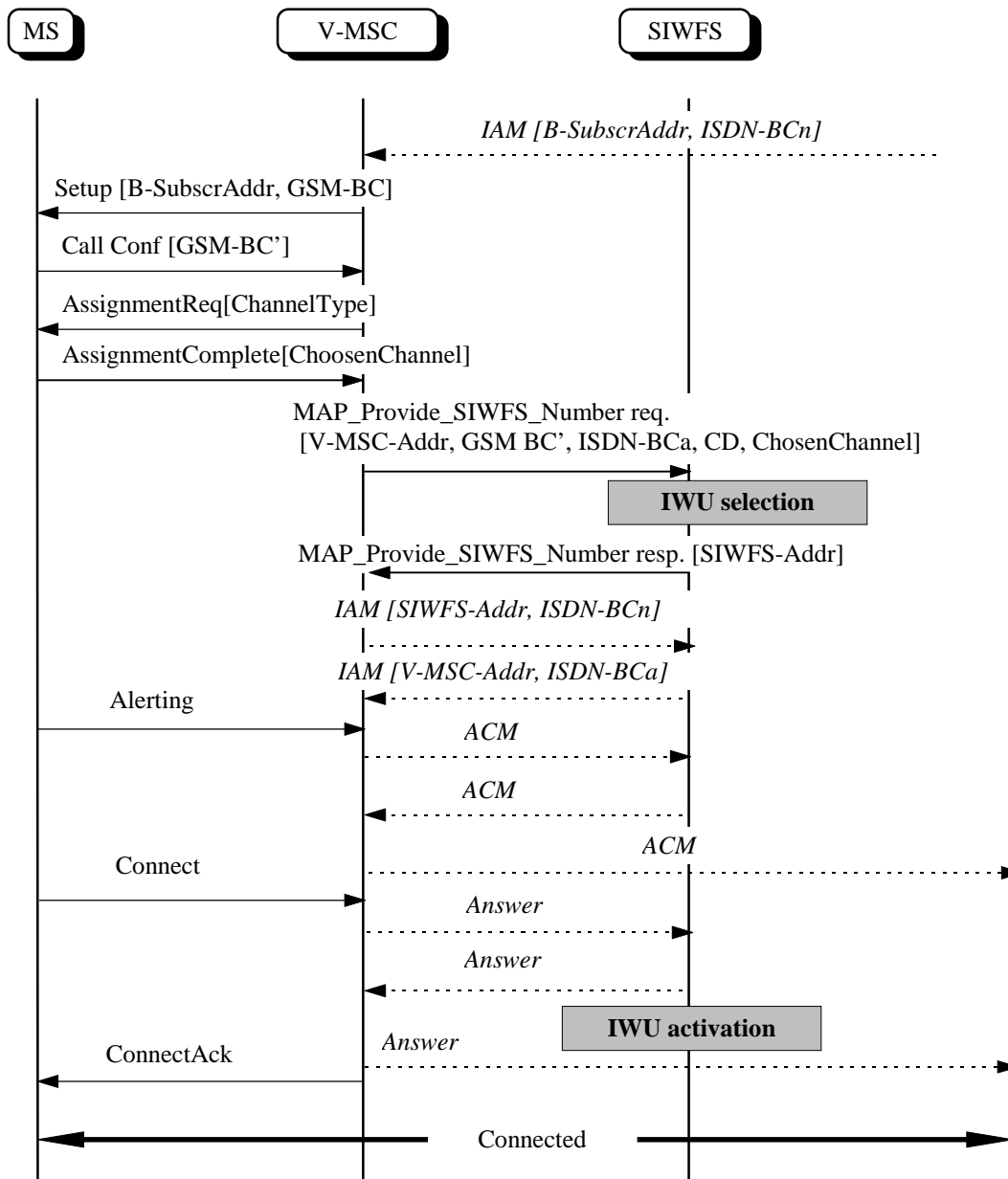


Figure 7: Call flow for MTC in the case of the loop method

5.3.2 Call Flow for MTC (Non-Loop Method)

The non-loop method is not defined for mobile terminated calls.

5.4 In Call Modification (ICM)

This subclause describes the procedure used to handle In Call Modification (ICM). ICM is applicable for Alternate Speech/fax (TS61), Alternate Speech/data (BS61) and Speech followed by data (BS81). In general the loop between the visited MSC and the SIWFS is only established when a dual service is in data/fax mode.

In the case when no resources are available at an ICM, the call will proceed in its existing mode, e.g. if no IWF resources are idle when going from speech to fax, the call will proceed in speech mode.

5.4.1 Call in Data/Fax Mode

The **visited MSC** that receives a MODIFY (GSM-BC, RCD) for a dual service in data/fax mode and accepts the ICM request, results in that the SIWFS connection is by-passed i.e.

- the loop to SIWFS is released;
- the MAP Dialogue is closed.

This procedure is independent whether the call originally has been established as MOC or MTC. The parameter RCD (Reverse Call Direction) is normally transformed according to figure 8. For release it may be omitted.

When receiving the next ICM (return-to-data ICM) the visited MSC re-connect the SIWFS connection in accordance with subclause 5.4.2. This SIWFS connection may not be the same as the previous one.

5.4.2 Call in Speech Mode

The **visited MSC** that receives a MODIFY (GSM-BC, RCD) for a dual service in Speech mode and accepts the ICM request, and which decides to use an SIWF, results in that a loop to the SIWFS is established. The procedure is similar to Mobile Originated Call (Subclause 5.2) and Mobile Terminated Call (Subclause 5.3). This includes:

- selection of an appropriate SIWFS;
- sending a request to the SIWFS;
- waiting for an acknowledgement from the SIWFS;
- routing the call to the SIWFS and allocating an 'a' or 'n' -circuit to this entity.

The visited MSC decides the selection of a SIWFS after the ASSIGNMENT COMPLETE has been received. The selection of an appropriate SIWFS or MSC/IWF is based

- on the relevant parameters in the signalling messages (MODIFY and ASSIGNMENT COMPLETE);
- on status information from IWF and SIWFS together with normal route supervision;
- on further criteria's that can be determined by the operator (e.g. conditions for routing).

The visited MSC allocate a temporary V-MSC address (V-MSC-Addr) similar to MSRN (E.164 number). This address will be used by the visited MSC to correlate the incoming IAM messages from SIWFS. The visited MSC sends a request to the selected SIWFS by means of a MAP_Provide_SIWFS_Number procedure. The MAP_Provide_SIWFS_Number procedure contains all information needed for the SIWFS to evaluate the requirement and to select and to seizure an appropriate IWU. In particular, these information are

- V-MSC-Addr: The address, an E.164 number, where the SIWFS has to route the call i.e. the address of the visited MSC;
- GSM-BC: The GSM-BC in the MODIFY MESSAGE;
- ISDN-BC: The ISDN-BC mapped from the GSM-BC (MOC) or received from the fixed network (MTC);
- CDm: Call Direction to indicate the direction at call set-up (MOC/MTC) for the loop. It is derived from the original call set-up direction (CDo) and from the value of the reverse data Call Direction (RCD) parameter of the MODIFY message (see figure 8).
- Chosen Channel: The Chosen Channel specifies the assigned radio channel.

The visited MSC waits for the acknowledgement MAP_Provide_SIWFS_Number_Ack.

The **SIWFS** assigns and returns a temporary SIWFS address (similar to MSRN), an E.164 number. This address will be used by the visited MSC to route the call, i.e. the IAM to the SIWFS and it will be used by the SIWFS to correlate the incoming IAM to the corresponding MAP message MAP_Provide_SIWFS_Number (i.e. Call Reference).

The SIWFS sends the acknowledgement MAP_Provide_SIWFS_Number_Ack back to the visited MSC.

If the acknowledgement is negative (possibly indicated via the MAP procedure), the **visited MSC** may release the call or it may select an alternative SIWFS. The number of routeing alternatives is an implementation issue and not a part of this specification.

If the acknowledgement is positive, the visited MSC will set-up an 'a'-circuit (if CDm = MOC) or an 'n'-circuit (if CDm = MTC) towards the SIWFS. The ISDN-BC1 or ISDN-BC2 used for allocating the 'n'-circuit indicates a "UDI" connection, the transmission medium requirement for the 'a'-circuit is set to "64 kbit/s unrestricted".

If no valid response is received in the ISUP-signalling the visited MSC may select an alternative route to the same SIWFS, release the call or it may select an alternative SIWFS. The number of routeing alternatives is an implementation issue and not a part of this specification.

Normal ISUP signalling follows. The IAM to SIWFS contains ISDN-BC1, which is determined in accordance with figure 9.

The **SIWFS** routes the call to the address that it has got from the visited MSC i.e. the address of the visited MSC. This address is conveyed as parameter in the message MAP_Provide_SIWFS_Number. So, the SIWFS routes the call to the visited MSC and allocates an 'a'-circuit or an 'n'-circuit towards the visited MSC. The 'a'- and 'n'-circuit depends on the value CDm in the MAP_Provide_SIWFS_Number_Req. If the call routeing is not possible it releases the call by ISUP means.

Normal ISUP signalling follows. The IAM to the visited MSC contains ISDN-BC2, which is determined in accordance with figure 9. When the SIWFS receives the ISUP Answer message it activates the IWU.

CDo	Modify RCD	BC1	BC2	CDm
MOC	Reverse	n	a	MTC
MOC	--	a	n	MOC
MTC	Reverse	a	n	MOC
MTC	--	n	a	MTC

Figure 8: Selection of the ISDN-BC1, ISDN-BC2 and CDm. These are dependant on the original Call Direction (CDo) and Reverse Call Direction Information Element (RCD-IE) of the MODIFY message

5.4.3 Call Flow for ICM Procedure

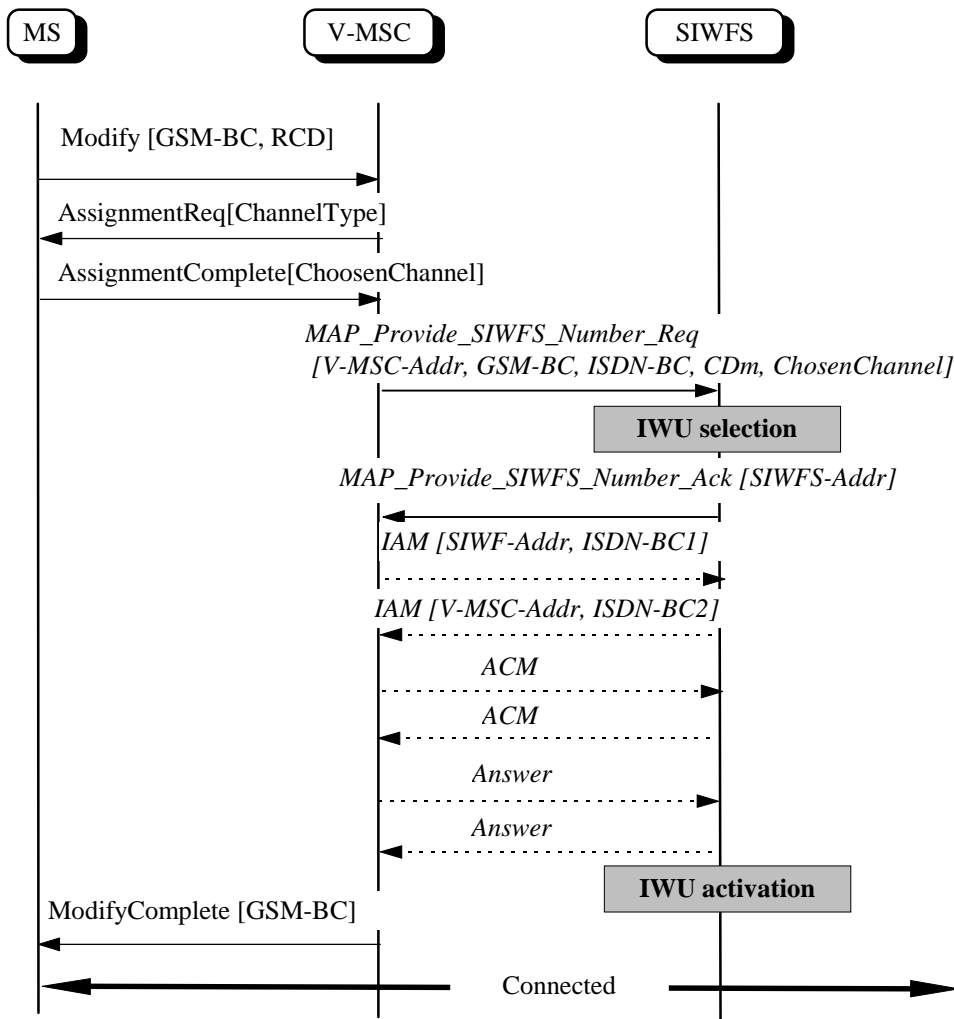


Figure 9: Call flow for In Call Modification procedure (change from speech to data/fax)

5.5 Modifications in a connection

There are BSSAP messages and procedures that are relevant for the MSC/IWF and SIWFS, that are not mapped to any ISUP message. These are messages for modification on channel mode and messages for resource up- and downgrading. The MAP procedure MAP_SIWF_Signalling is used to convey these messages between the visited MSC and the SIWFS.

5.5.1 Channel Mode Modify (CMM)

Channel Mode Modify (CMM) concerns TS61 and TS62. The purpose of CMM is to adjust the radio channel bit rate to match the message speed negotiated end-to-end between the fax machines. The CMM procedure is initiated by the FA/IWF.

The procedures for CMM follow the procedures described in GSM 03.45.

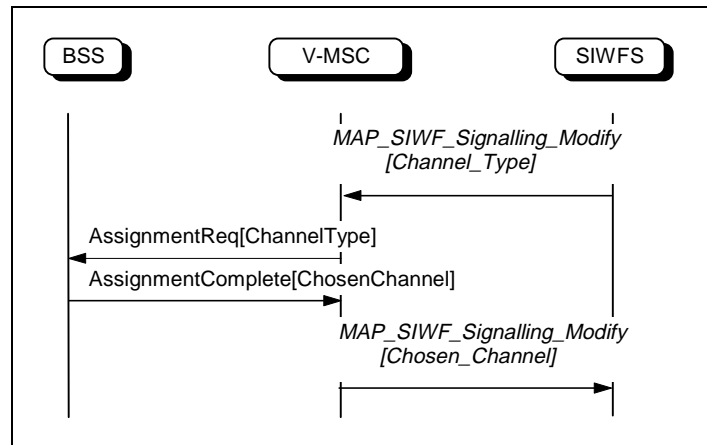


Figure 10: Call flow for Channel Mode Modify procedure

5.5.2 User initiated resource up- and down grading

During a Non Transparent Multislot configuration the user may request the network to change the current maximum number of traffic channels and air interface user rate parameters. This procedure is described in GSM 03.34.

When the visited MSC receives the changed configuration after ASSIGNMENT COMPLETE the IWU of the SIWFS is adjusted accordingly by means of MAP_SIWF_Signalling procedure.

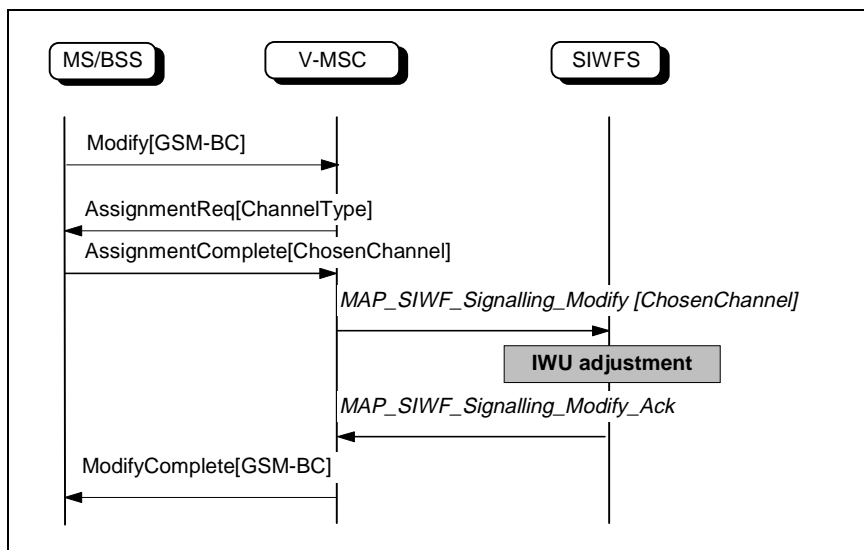


Figure 11: Call flow for user initiated resource up- and downgrading. MODIFYCOMPLETE may be sent either as shown in figure or immediately after MODIFY

5.5.3 Network Resource up- and downgrading

During a call using a multislot configuration the Number of assigned traffic channels and/or the air interface user rate and/or the channel type may be modified. Also for a call using a singleslot configuration the assigned channel mode can change (e.g. from TCH/F to TCH/H or vice versa).

When the visited MSC receives the changed configuration e. g. the message HANDOVER PERFORMED the IWU of the SIWFS is adjusted accordingly.

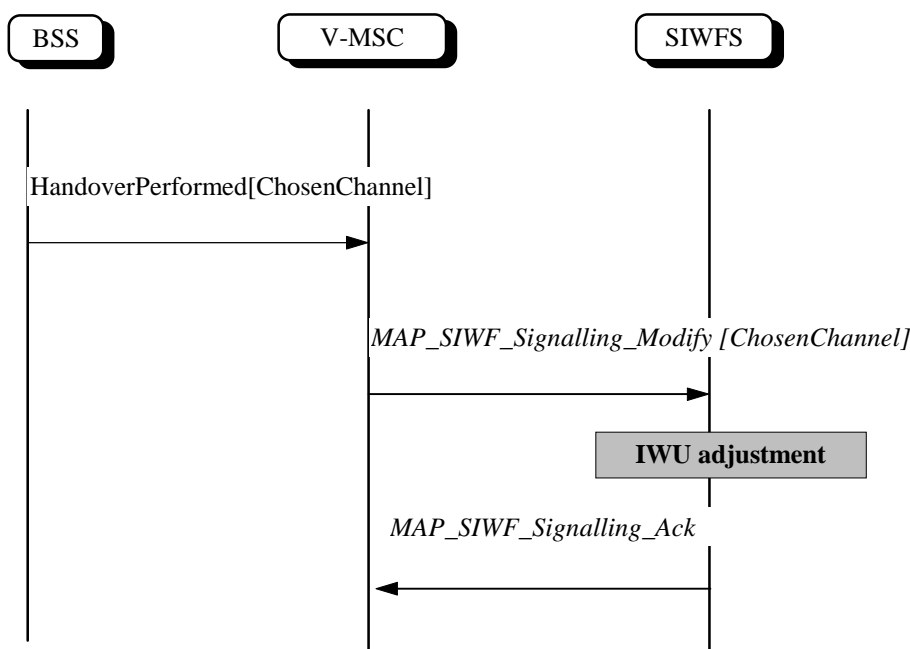


Figure 12: Call flow for network Resource Up- and Downgrading

5.6 Release

RELEASE follows the ISUP procedures. RELEASE may be initiated by either V-MSC or SIWFS by sending an ISUP REL message. The call is released and the MAP link between V-MSC and SIWFS is closed (MAP-CLOSE).

5.7 Negotiation of parameters

The MSC is responsible for the negotiation and setting of parameters in accordance with GSM 07.01. The protocol on the K Interface supports the submission of all needed Bearer Capabilities (GSM and ISDN) in accordance with GSM 09.07.

5.8 Inter MSC handover

In case of an inter MSC handover, the originally MSC i.e. the anchor MSC maintains the connection to and control of the SIWFS resources. Thus it is to be noted that in such cases, three MSCs are involved at the serving side of the call and the route from the MS is in the sequence MSCb-MSCa-SIWFS-MSCa- Fixed network (in the loop method case).

5.9 Reset

RESET follows the ISUP procedures. RESET may be initiated by either V-MSC or SIWFS by sending an ISUP RSC message. The circuit is reseted and possible MAP link between the V-MSC and the SIWFS is closed (MAP-CLOSE).

6 SIWF and Supplementary Services

Supplementary Services shall not be affected by the concept of the SIWF. The Supplementary Services applicable for data services are defined in GSM 02.04.

NOTE: Supplementary Services may depend on the signalling system between visited MSC, fixed network and SIWFS. This dependence is described in other specifications and it is outside the scope of this specification.

6.1 Number Identification Supplementary Services

The parameters related to the number identification Supplementary Services are passed transparently through SIWFS as received in the signalling from visited MSC or fixed network. This is applicable for CLIP, CLIR, COLP and COLR.

6.2 Call Offering Supplementary Services

In the case the call is a normal MTC and the B-subscriber does not answer, the call may be Call Forwarded on No Reply (CFNRy). This situation requires that the allocated resources are released, when the call is forwarded.

CFU, CFB and CFNRc have no impact.

6.3 Call Waiting (CW)

No impact.

6.4 Closed User Group (CUG)

The parameters related to Closed User Group (CUG) are passed transparently through SIWFS as received in the signalling from visited MSC or fixed network.

6.5 User-to-User Supplementary Services

The parameters related to User-to-User signalling are passed transparently through SIWFS as received in the signalling from visited MSC or fixed network.

6.6 Charging Supplementary Services

No impact. This is applicable for AoCI and AoCC.

6.7 Call Restrictions

No impact. This is applicable for the barring services e. g. BAOC, BOIC, BOIC-exHC, BAIC and BAIC-Roam.

6.8 Support of Private Numbering Plan (SPNP)

No impact.

6.9 Call Completion on Busy Subscriber (CCBS)

The parameters related to CCBS are passed transparently through SIWFS as received in the signalling from visited MSC or fixed networks.

7 Interaction with CAMEL

Interaction with CAMEL is outside the scope of this specification.

8 Operation and Maintenance Aspects

The operators have the possibility to:

- Set the parameters for conditional routing. The following parameters can be used: A-Number, B-Number, Bearer Services and Tele Services.
- Specify the routing alternatives.

9 Charging

A visited MSC, which have determined to use a SIWFS, is responsible for Charging. This is applicable both for Loop and Non Loop method.

10 Interception

The service definition (stage 1) on Lawful Interception (GSM 02.33) states that all tele and bearer services are subject to interception.

Provided that a mechanism for the interception of dataservice exists, interception is supported for both Loop or Non Loop method.

History

Document history		
V5.0.0	July 1997	Publication
V5.1.0	November 1997	Publication
V5.2.0	January 1998	Publication