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Mobile services Switching Centre (MSC) -
Fixed Part (FP) interconnection**

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Foreword

This European Telecommunication Standard (ETS) has been produced by the Radio Equipment and Systems (RES) Technical Committee of the European Telecommunications Standards Institute (ETSI).

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Introduction

This ETS is a part of a set of standards for the Digital Enhanced Cordless Telecommunications / Global System for Mobile Communications (DECT/GSM) Interworking Profile (IWP) concept that includes:

- general description of service requirements, functional capabilities and information flows, ETS 300 466 [7];
- access and mapping (protocol/procedure description for 3,1 kHz speech service), ETS 300 370 [6];
- GSM Phase 2 supplementary services implementation, ETS 300 703 [8];
- GSM MSC - DECT Fixed Part (FP) interconnection, (this ETS).

Other standards of the DECT/GSM IWP are expected to describe (see annex C):

- implementation of bearer services, ETS 300 756 [14];
- implementation of short message services, point-to-point and cell broadcast, ETS 300 764 [13];
- implementation of facsimile group 3, DE/RES-03072 [19].

This ETS is based on Digital Enhanced Cordless Telecommunications (DECT) Common Interface specification ETS 300 175 [18] and ETS 300 370 [6] to enable DECT terminals to interwork in the public and private environment with DECT systems which are connected to a Global System for Mobile communications (GSM) core infrastructure. From the GSM side this ETS is based upon the specifications of the GSM 08.0X series of Technical Specifications (TSs) [1] to [5]. Information on DECT access to the GSM PLMN may be found in ETR 159 [9]. Further details on the DECT system may be found in ETR 015 [10], ETR 043 [11], and ETR 056 [12].

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1 Scope

This European Telecommunication Standard (ETS) is a part of the Digital Enhanced Cordless Telecommunications / Global System for Mobile Communications (DECT/GSM) Interworking Profile (IWP) and specifies the interface used between the Digital Enhanced Cordless Telecommunications (DECT) Fixed Part (FP) and the Global System for Mobile communications (GSM) Mobile Switching Centre (MSC). This ETS specifies the exceptions to the GSM 08.0X series of Technical Specifications (TSs) [1] to [5] and only places requirements on the DECT FP.

For the purposes of Call Control (CC) and Mobility Management (MM), most messages are not interpreted, but relayed to the underlying DECT radio sub-system. Some messages may however be interpreted and handled at the interconnection. The DECT access protocols and a particular set of FP interworking functions/mappings to ensure that the GSM services can be provided over DECT are specified in ETS 300 370 [6] and ETS 300 466 [7].

The DECT sub-system uses the A-interface in the respect that the FP emulates a GSM Base Station Controller (BSC). This ETS covers the handling of procedures that are applicable on the A-interface in order to ensure an appropriate GSM BSC emulation. It also covers error conditions at the interface, handling of timers and handling of message headers that are required for the correct addressing of messages.

Interworking between the DECT FP and the GSM MSC via other interfaces is outside the scope of this ETS.

2 Normative references

This ETS 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 ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] ETS 300 587-1: "European digital cellular telecommunications system (Phase 2); Base Station System - Mobile-services Switching Centre (BSS - MSC) interface; General aspects (GSM 08.01)".
- [2] ETS 300 587-2: "European digital cellular telecommunications system (Phase 2); Base Station System - Mobile-services Switching Centre (BSS - MSC) interface; Interface principles (GSM 08.02)".
- [3] ETS 300 588 : "European digital cellular telecommunications system (Phase 2); Base Station System - Mobile-services Switching Centre (BSS - MSC) interface; Layer 1 specification (GSM 08.04)".
- [4] ETS 300 589 : "European digital cellular telecommunications system (Phase 2); Signalling transport mechanism specification for the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface (GSM 08.06)".
- [5] ETS 300 590: "Digital cellular telecommunications system (Phase 2); Mobile-services Switching Centre - Base Station System (MSC - BSS) interface; Layer 3 specification (GSM 08.08)".
- [6] ETS 300 370: "Radio Equipment and Systems (RES); Digital European Cordless Telecommunications/Global System for Mobile communications (DECT/GSM) inter-working profile; Access and mapping (Protocol/procedure description for 3,1 kHz speech service)".
- [7] ETS 300 466: "Radio Equipment and Systems (RES); Digital European Cordless Telecommunications/Global System for Mobile Communications (DECT/GSM) interworking profile; General description of service requirements; Functional capabilities and information flows".

- [8] ETS 300 703: "Radio Equipment and Systems (RES); Digital Enhanced Cordless Telecommunications/Global System for Mobile communications (DECT/GSM) Interworking Profile (IWP); GSM phase 2 supplementary services implementation".
- [9] ETR 159: "Radio Equipment and Systems (RES); Digital European Cordless Telecommunications (DECT); Wide area mobility using the Global System for Mobile communications (GSM)".
- [10] ETR 015: "Radio Equipment and Systems; Digital European Cordless Telecommunications (DECT); Reference document".
- [11] ETR 043: "Radio Equipment and Systems (RES); Digital European Cordless Telecommunications (DECT); Common interface; Services and facilities requirements specification".
- [12] ETR 056: "Radio Equipment and Systems (RES); Digital European Cordless Telecommunications (DECT); System description document".
- [13] ETS 300 764: "Radio Equipment and Systems (RES); Digital Enhanced Cordless Telecommunications / Global System for Mobile communications (DECT/GSM) inter-working profile; Implementation of short message service, point-to-point and cell broadcast".
- [14] ETS 300 756: "Radio Equipment and Systems (RES); Digital Enhanced Cordless Telecommunications / Global System for Mobile communications (DECT/GSM) interworking profile; Implementation of bearer services".
- [15] ETS 300 704-1: "Radio Equipment and Systems (RES); Digital Enhanced Cordless Telecommunications/Global System for Mobile communications (DECT/GSM) Interworking Profile (IWP); Profile Implementation Conformance Statement (ICS)); Part 1: Portable radio Termination (PT)".
- [16] ETS 300 704-2: "Radio Equipment and Systems (RES); Digital Enhanced Cordless Telecommunications/Global System for Mobile communications (DECT/GSM) interworking Profile (IWP); Profile Implementation Conformance Statement (ICS)); Part 2: Fixed radio Termination (FT)".
- [17] ETS 300 702: "Radio Equipment and Systems (RES); Digital Enhanced Cordless Telecommunications / Global System for Mobile communications (DECT/GSM) interworking profile".
- [18] ETS 300 175: "Radio Equipment and Systems (RES); Digital European Cordless Telecommunications (DECT); Common Interface (CI)".
- [19] DE/RES-03072: "Radio Equipment and Systems (RES); Digital European Cordless Telecommunications/Global System for Mobile Communications (DECT/GSM) interworking profile; Implementation of facsimile group 3".

3 Definitions and abbreviations

3.1 DECT definitions

This subclause only includes DECT definitions valid for this ETS. A complete list of DECT definitions may be found in ETS 300 370 [6].

DECT Network (DNW): A network that uses the DECT air interface to interconnect a local network to one or more portable applications. The logical boundaries of the DECT network are defined to be at the top of the DECT Network (NWK) layer.

NOTE 1: A DNW is a logical grouping that contains one or more Fixed radio Terminations (FTs) plus their associated Portable radio Termination (PT). The boundaries of the DECT network are not physical boundaries.

Fixed Part (FP), DECT FP: A physical grouping that contains all of the elements in the DECT network between the local network and the DECT air interface.

NOTE 2: A DECT FP contains the logical elements of at least one FT, plus additional implementation specific elements.

Fixed Part GSM PLMN attachment (DECT fixed part attached to a GSM MSC): A definition of a functional environment where a DECT system (FP) is attached to a GSM MSC. The MSC in this case refers to a functional entity providing the required MM and CC functionality defined in this ETS in order to communicate with the FP.

Interworking Unit (IWU): A unit that is used to interconnect sub-networks.

NOTE 3: The IWU will contain the inter-working functions necessary to support the required sub-network interworking.

Portable Part (PP), DECT PP: A physical grouping that contains all elements between the user and the DECT air interface. PP is a generic term that may describe one or several physical pieces.

NOTE 4: A DECT PP is logically divided into one portable termination plus one or more portable applications.

3.2 Abbreviations

For the purposes of this ETS the following abbreviations apply:

BSC	GSM Base Station Controller
BSSAP	Base Station System Application Part
BSSMAP	GSM Base Station System - Mobile Application Part
BSSOMAP	Base Station System Operation and Maintenance Part
DCMAP	DECT Connection and Mobility Application Part
DECT	Digital Enhanced Cordless Telecommunications
DLCI	Data Link Connection Identifier
DTAP	Direct Transfer Application Part
FP	Fixed Part
FPAP	Fixed Part Application Part
FPMAP	Fixed Part Management Application Part
FPOMAP	Fixed Part Operation and Maintenance Application Part
GSM	Global System for Mobile Communications
IPEI	International Portable Equipment Identity
IWU	Interworking Unit
MM	Mobility Management, a NWK layer functional grouping
MS	Mobile Station
MSC	Mobile Switching Centre
MTP	Message Transfer Part
NWK	Network layer
O&M	Operations & Maintenance

PLMN	Public Land Mobile Network
PP	Portable Part
SAPI	Service Access Point Identifier
SCCP	Signalling Connection Control Part
TS	GSM Technical Specification

4 General

This ETS is structured in the same way as GSM 08.0X series of TSs [1] to [5], but contained in a single document, i.e. each applicable GSM 08.0X TS [1] to [5] is included as a subclause in this ETS. Only the exceptions to the GSM 08.0X TSs [1] to [5] are specified in these subclauses.

5 FP-MSC interface

5.1 General aspects (ETS 300 587-1, GSM 08.01)

The FP-MSC interface shall be capable of supporting all the services offered to a DECT user with a GSM subscription.

The MSC to FP interface recommendation shall allow the following:

- a) connection of various manufactures FPs to the same MSC;
- b) the use of the same FPs in any PLMN;
- c) support of all services defined in ETS 300 370 [6] and ETS 300 466 [7].

The MSC to FP interface is specified by a set of characteristics, including:

- a) physical parameters;
- b) procedures.

The definition of the MSC to FP interface follows a layered approach almost identical to that used for the A-interface.

5.2 Interface principles (ETS 300 587-2, GSM 08.02)

This subclause gives the principles on which the detailed interface specifications in the rest of this ETS are based.

The set of fixed equipment accessed from the MSC through one particular instance of the interface will be referred to as a DECT FP. A FP ensures the coverage of (n) DECT Radio Fixed Parts (RFPs), where (n) can be one or more.

The interface is based on the use of one or more 2 048 kbit/s digital transmission system interfaces.

Each 2 048 kbit/s interface provides 31 x 64 kbit/s channels that can be used for traffic or signalling as the operator requires. The DECT radio path traffic channel is at a rate of 32 kbit/s.

A rate adapting function is thus needed for the rate conversion. This rate adapting function is considered to be a part of the FP, but could physically be located at the MSC's site. As there is only one rate adaption required on the MSC-FP interface, there is no need for the support of groups of circuits (circuit pools) having different capabilities.

The functional split between the FP and the MSC are similar to the functional split between a BSC and a MSC. Since DECT has a completely different radio management that does not use interworking, the number of functions handled by the FP will be less than for a GSM BSC.

The following functions shall be handled by the FP:

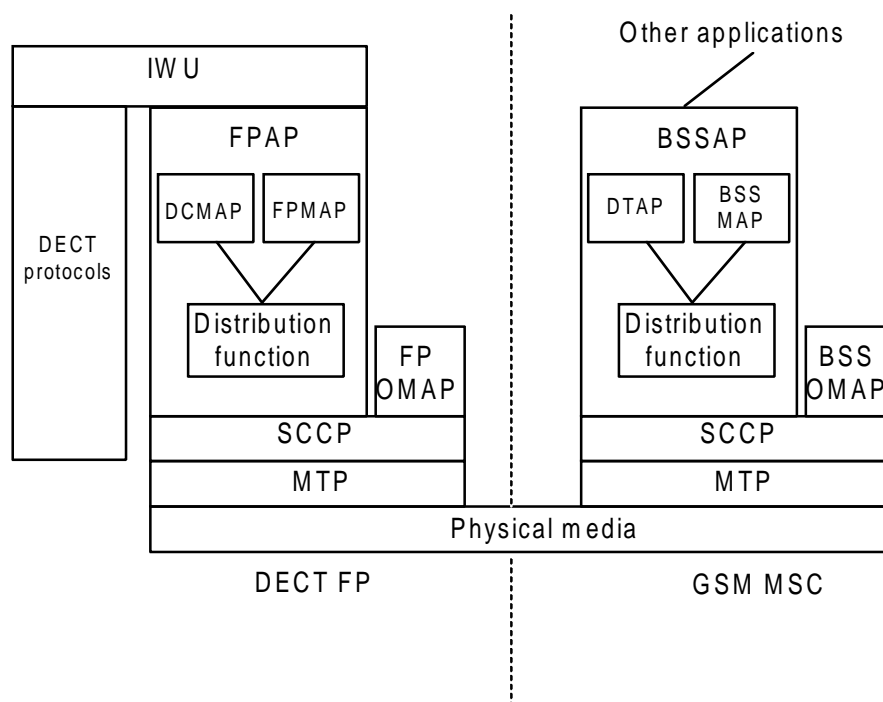
- terrestrial channel management;
- user data encryption;
- signalling element encryption;
- radio management;
- transcoding and rate adaption.

Signalling messages are classified under the three following headings:

- DECT Connection and Mobility Application Part (DCMAP) messages Fixed Part Application Part (FPAP) messages;
- Fixed Part Management Application Part (FPMAP) messages FPAP messages;
- Fixed Part Operation and Maintenance Application Part (FPOMAP).

DCMAP, FPMAP and FPAP are defined in clause 6.

The definition of the MSC to FP interface follows a layered approach, as shown in figure 1.



BSSOMAP: Base Station System Operation and Maintenance Part

Figure 1: MSC to FP interface

5.3 Layer 1 specification (ETS 300 588, GSM 08.04)

The FP-MSC Interface - Layer 1 specification is identical with the BSS-MSC Interface - Layer 1 specification as specified in ETS 300 588 [3] (GSM 08.04).

5.4 Signalling transport mechanism (ETS 300 589, GSM 08.06)

The FP-MSC Interface - Signalling transport mechanism is identical with the BSS-MSC Interface - signalling transport mechanism as specified in ETS 300 589 [4] (GSM 08.06) with the following exceptions:

- all appearances of Base Station System Application Part (BSSAP), Direct Transfer Application Part (DTAP) and GSM Base Station System - Mobile Application Part (BSSMAP) shall be replaced with FPAP, DCMAP and FPMAP respectively.

6 Application to layer 3 interface structures

The underlying transport mechanism defined to carry signalling information between the FP and the MSC is the Message Transfer Part (MTP), and the Signalling Connection Control Part (SCCP) of signalling system No. 7.

The MTP and SCCP are used to support communication between the MSC and two conceptual entities within the FP. These are:

- FP Operation and Maintenance Application Part (FPOMAP); and
- FP Application Part (FPAP).

The FPAP is split into two sub-application parts. These are:

- FP Management Application Part (FPMAP); and
- DECT Connection and Mobility Application Part (DCMAP).

The set of FPMAP procedures shall be seen as a subset of the BSSMAP procedures on the FP side of the MSC-FP interface (called A-interface for similarity reasons with the MSC-BSC interface).

As it is considered that the MSC is not aware of interfacing an FP, it may use BSSMAP procedures that are not defined as FPMAP procedures. The FP will then apply the corresponding error handling defined in subclause 7.1.16. The same applies for BSSMAP messages, information elements and coding values that are not defined as FPMAP messages, information elements and coding values, respectively.

In this ETS, a BSSMAP procedure defined in ETS 300 590 [5] (GSM 08.08) is defined as applicable when at least both entities (MSC and FP) are able to identify it. This procedure is then defined as a FPMAP procedure.

In the direction MSC -> FP, all information elements are applicable. This means that the FP shall at least be able to ignore the information elements. In the direction MSC -> FP, some information element coding values are not applicable. This means that the FP shall be able to apply the correct error handling defined in this specification when a non-applicable value is met by the FP.

When there is an exception to any procedure in ETS 300 590 [5] (GSM 08.08) the entire procedure is re-written.

6.1 The FP operation and maintenance application part

If operation and maintenance messages are transferred by means of this interface they shall use SCCP messages. FPOMAP is for further study.

6.2 The DCMAP

The DCMAP is used to transfer Connection Management and Mobility Management information between the MSC and the PP. An interworking function in the FP handles the mapping of protocol entities between the DCMAP and the DECT radio interface protocols. This interworking is specified in ETS 300 370 [6] and ETS 300 466 [7].

The set of DCMAP procedures is a subset of the DTAP Connection and MM procedures.

6.3 The FP Management Application Part, FPMAP

The FPMAP supports all of the procedures between the MSC and the FP that require interpretation and processing of information related to single calls and management of terrestrial resources.

6.4 Handling of abnormal events related to the FPAP header

The handling of the FPAP header is identical with the handling of the BSSAP header as specified in TS ETS 300 590 [5] (GSM 08.08).

7 The FP management application part

7.1 FPMAP procedures

The BSSMAP procedures (see ETS 300 590 [5] (GSM 08.08)) applicable, to some extent, on the A-interface and called FPMAP procedures are:

- * Assignment;
- # Blocking;
- # Reset;
- * Handover required indication;
- * Handover resource allocation;
- * Handover execution;
- * Release;
- # Paging;
- # Flow control;
- * Cipher mode control;
- * Trace invocation;
- * Initial PP message;
- * Data link control SAPI not equal to 0;
- # Reset circuit;
- * Internal handover;
- # Load indication.

NOTE: Each of the above procedures are qualified by either an asterisk (*) or as a hash symbol (#). The hash (#) symbol denotes a global procedure that concerns a complete FP or specific terrestrial circuits. The asterisk (*) symbol denotes a dedicated procedure that concerns a single PP.

In addition to these procedures, the procedures for error handling are also specified.

All BSSMAP messages related to other BSSMAP procedures shall be considered as messages with non-existent message type if received by the FP.

Messages used to support global procedures are sent using the connectionless services of the SCCP.

Messages used to support dedicated procedures are sent using the connection oriented services of the SCCP, on the connection that has been set up to support that call or transaction. The establishment of SCCP connections is detailed in ETS 300 589 [4] (GSM 08.06).

In the following description of each procedure specified as an exception to ETS 300 590 [5] (GSM 08.08) it is explicitly stated whether the procedure is global or not, and hence the type of SCCP service used to support the defined procedure.

The handling of unknown terrestrial circuits is defined in FPMAP error handling, subclause 7.1.16 and these procedures take precedence over those of the rest of this subclause. The procedures defined in this subclause assume that the terrestrial circuit is known by the entity concerned.

7.1.1 Assignment procedure

The purpose of the assignment procedure is to allocate a terrestrial resource to a DECT PP by provision of a Circuit Identity Code (CIC) to the FP and to ensure that the correct dedicated radio resources are allocated.

7.1.1.1 Successful operation

The initial conditions are assumed to be that the DECT PP is in contact with the fixed infrastructure of a PLMN and that the MSC has analysed any relevant call control information and wishes to allocate a terrestrial resource to the PP.

The MSC is the entity that carries out the necessary analysis on the connection management information received from the PP or the fixed network customer.

On the basis of this analysis, a resource request is made to the appropriate FP by sending it an ASSIGNMENT REQUEST. This message contains the circuit identity code that identifies the terrestrial resource that the FP shall use. The selection of this circuit can be done in the MSC regardless of the requested channel type. All other information available in the ASSIGNMENT REQUEST will be ignored unless otherwise specified in subclause 7.3.

An ASSIGNMENT COMPLETE message shall be sent to the MSC as soon the requested resource has been allocated within the FP. If the MSC gave the FP some freedom in resource type selection, the choices made by the FP are indicated in the ASSIGNMENT COMPLETE message.

If the assignment requires a change of terrestrial circuit or in the case of assignment for signalling the release of a previously used terrestrial circuit, the change or release shall be performed before the ASSIGNMENT COMPLETE message is sent and the BSS shall consider that the old terrestrial circuit is idle.

After the completion of the assignment procedure, until the connection is released or the MSC performs a new assignment, any dedicated resource assigned to the mobile station, e.g. at internal handover, must be in accordance with the description in the ASSIGNMENT REQUEST message.

7.1.2 Assignment failure

An FP may not be able to use the terrestrial resource that the MSC has indicated, in which case an ASSIGNMENT FAILURE message will be returned with the cause value "Requested terrestrial resource unavailable".

Other possible cause values that may be returned with the ASSIGNMENT FAILURE message are:

- "Equipment failure";
- "O&M intervention".

In the case where the MSC has attempted to assign a terrestrial circuit and an ASSIGNMENT FAILURE message has been returned, then both the MSC and FP shall consider that the terrestrial circuit is idle (except as described below in subclause 7.1.2.1) and therefore no explicit clearing sequence is needed.

All messages concerned with an assignment are sent using the connection oriented mode of the SCCP.

7.1.2.1 Abnormal conditions

If the FP receives an ASSIGNMENT REQUEST message calling up a terrestrial circuit that is already assigned to another call, then an ASSIGNMENT FAILURE message will be returned with the cause:

- "Terrestrial circuit already allocated".

If the FP receives an ASSIGNMENT REQUEST message allocating a terrestrial resource that has been blocked by a global block message, then an ASSIGNMENT FAILURE message shall be sent with cause: "Requested terrestrial resource unavailable". A single global BLOCK message (not repeated and not guarded by timer T1) shall be sent for that concerned terrestrial resource.

7.1.3 Blocking and unblocking

Blocking and unblocking procedures are identical with the blocking and unblocking procedures as specified in ETS 300 590 [5] (GSM 08.08).

NOTE: The use of Circuit Group Blocking and Circuit Group Unblocking messages is not essential for the correct functioning of the MSC FP interface and may increase the complexity of the FP.

7.1.4 Reset

7.1.4.1 Global reset procedure

The FPMAP global reset procedure is identical with the BSSMAP global reset procedure as specified in ETS 300 590 [5] (GSM 08.08).

7.1.4.2 Reset circuit

The FPMAP reset circuit procedure is identical with the BSSMAP circuit reset procedure as specified in ETS 300 590 [5] (GSM 08.08).

7.1.5 Release

7.1.5.1 Release due to transaction completion

The release of a terrestrial resource at the end of a transaction will take place as follows:

- release negotiation will take place between the PP and MSC via the IWU, using DCMAP messages;
- the MSC will then send a FPMAP CLEAR COMMAND, indicating that the terrestrial resource should be released;
- after the CLEAR COMMAND has been sent, the MSC shall not send further FPMAP connection oriented messages on this particular connection, except CLEAR COMMAND.

When the FP receives the CLEAR COMMAND:

- the FP marks any assigned terrestrial resources as idle, starts the release of the connection on the DECT air-interface, and returns a CLEAR COMPLETE message.

On receipt of CLEAR COMPLETE, the MSC releases any assigned terrestrial resources.

7.1.5.2 Release due to FP generated reasons

If a release of a terrestrial resource is needed because of a FP generated reason (e.g. O and M intervention, equipment failure) then, the FP shall generate a CLEAR REQUEST message towards the MSC. This message shall include a cause information element, indicating the reason for the release.

If the connection to/from a PP is lost or released, then a CLEAR REQUEST message shall be sent to the MSC. The cause value in the CLEAR REQUEST message shall indicate the reason for clearing. Typical cause values include: "radio interface failure" or "no radio resource available".

On receipt of a CLEAR REQUEST the MSC shall initiate the release, as defined above, by sending a CLEAR COMMAND message. On receipt of this message the FP shall, if the resources are not already internally released, release the resources in the normal way. The procedure is always terminated with a CLEAR COMPLETE sent to the MSC.

7.1.6 Paging

The PAGING message for a PP shall be sent via the FPMAP as a connectionless message. This message will include the IMSI of the PP. Other information may also be provided, e.g. the Cell Identifier List information element.

As specified in ETS 300 370 [6], upon receipt of the response to the DECT radio interface paging request, the FP shall interwork a PAGING RESPONSE message. This message shall be included in a COMPLETE LAYER 3 INFORMATION message and used by the FP to set up an SCCP connection towards the MSC as described in ETS 300 589 [4] (GSM 08.06).

7.1.7 Trace invocation

The purpose of the trace invocation procedure is to inform the receiving entity that it should begin producing a trace record on this particular transaction.

The trace is invoked by the MSC sending a MSC INVOKE TRACE message to the FP.

The events and parameters to be recorded are indicated in the Trace T type information element.

The MSC may allocate and include a "MSC transaction reference". The transaction reference is contained in the information element "TransactionId". The message includes a trace reference that is allocated by the entity that triggered the trace.

The element "TriggerId", if present, indicates the entity that triggered the trace.

The messages are not acknowledged and are sent as a connection oriented message on the connection on which a trace record is required.

7.1.8 Flow control

These procedures are defined to give some degree of flow control. For both FP and MSC these procedures relate to processor overload.

7.1.8.1 Philosophy

The philosophy used is to stem the traffic at source with known effect on the service. The algorithm specified in ETS 300 590 [5] (GSM 08.08) shall be used.

7.1.8.2 Processor overload at the MSC

The MSC can indicate to the FP that it is in a congested state by sending an OVERLOAD message. This is sent as a connectionless global message.

7.1.8.3 Processor overload at the FP

If the FP processing is overloaded then the FP sends an OVERLOAD message with the cause value: "processor overload".

7.1.8.4 Message throughput congestion

If the lower layers of the protocol become congested then it is assumed that the MTP congestion indication will take place and the source of the traffic will receive primitives from the transport protocols resulting in it reducing the generated load.

7.1.9 Cipher mode control

7.1.9.1 Successful operation

The cipher mode control procedure enables the MSC to pass cipher information to the FP.

This is achieved by sending to the FP a CIPHER MODE COMMAND message. Receipt of this message at the FP will, if the Start Ciphering bit is set to one, cause the generation of a DECT radio interface CIPHER-REQUEST message. When ciphering of the DECT air interface has been acknowledged the FP shall send a CIPHER MODE COMPLETE to the MSC.

NOTE: Conversion of GSM ciphering keys into DECT keys is described in ETS 300 370 [6].

When no permitted encryption algorithm is indicated in the CIPHER MODE COMMAND message, then the FP shall only respond with a CIPHER MODE COMPLETE message to the MSC.

If within the CIPHER MODE COMMAND, the signalling element "Cipher response mode" is present and indicates "IMEISV must be included by the MS (DECT PP)", then the FP shall request in the radio interface message IDENTITY-REQUEST the PP to include its International Portable Equipment Identity (IPEI) in an IDENTITY-REPLY message. This enquiry shall be performed after successful initiation of ciphering over the radio interface. The mapping between IPEI and IMEISV specified in ETS 300 370 [6] is then performed by the FP and IMEISV is returned in the layer 3 message contents information element.

In the CIPHER MODE COMMAND the MSC may offer a choice of which of the ciphering algorithms may be used by the FP. In the CIPHER MODE COMPLETE message returned to the MSC the FP shall indicate which ciphering algorithm it has chosen. The chosen ciphering algorithm should be indicated as specified in ETS 300 590 [5].

NOTE: The CIPHER MODE COMMAND message may indicate a request to stop ciphering on the DECT air Interface.

The CIPHER MODE COMMAND and CIPHER MODE COMPLETE messages are sent as connection oriented SCCP messages.

7.1.9.2 Unsuccessful operation

If the FP is unable to accept the ciphering algorithm(s) specified in the CIPHER MODE COMMAND message, then it shall return a CIPHER MODE REJECT message with cause value "Ciphering algorithm not supported". A CIPHER MODE REJECT message shall also be returned if the MSC requests a change of ciphering algorithm when ciphering is already active.

7.1.10 General SCCP abnormal conditions

If a user-out-of-service information or signalling-point-inaccessible information is received by the FPMAP or FPOMAP, no new attempt to establish SCCP connections towards the affected point code will be started until the corresponding user-in-service information or signalling-point-accessible information is received.

When a user-out-of-service information or signalling-point-inaccessible is received by the FP an optional timer may be started. When the timer expires all the SCCP connections towards the affected point code will be released. When the user-in-service or signalling-point-accessible is received, the timer is stopped.

If for any reasons an SCCP connection is released, the optional timer expires or a connection refusal is received while any of the FP procedures is being performed or while a dedicated resource is still allocated the following actions are taken:

At FP:

- the radio interface connection associated with the SCCP connection is cleared;
- any FP procedure relating to that connection is abandoned;

- the resources allocated to the call associated to the connection are released.

At MSC:

- the call associated with the SCCP connection is cleared as soon as possible.

If the FP recognizes that a call has terminated, then a CLEAR REQUEST message should be generated.

If a 2 Mbits/s system fails and one of the standard alarms is received, no action is taken by the FP on the calls associated with the traffic channels involved.

At the MSC, calls should be cleared if either the subscriber clears, or if the FP sends a CLEAR REQUEST message. Clearing of affected calls by the MSC may take place after loss of traffic channels for a period defined by the operator.

7.1.11 Initial PP message

When the SCCP connection establishment is performed by the FP, the equivalent of initial received Layer 3 information on the DECT radio interface shall be mapped into an initial PP message as described in ETS 300 370 [6] and included in a FPMAP COMPLETE LAYER 3 INFORMATION message.

7.1.12 Data link control SAPI not equal to <<0>>

The DECT radio interface can support data links with SAPI not equal to <<0>>. However the DECT SAPI not equal to <<0>> are allocated to different services than those specified in ETS 300 555 (GSM 04.06). The FP interworking performed on messages whose Data Link Connection Identifier (DLCI) indicate a SAPI not equal to <<0>> or <<3>> is outside the scope of this ETS.

NOTE: SAPI equal to <<3>> is used for SMS.

7.1.12.1 Messages with SAPI value not equal to 0 across the MSC FP interface

This subclause only deals with the transfer of messages whose DLCI indicate a SAPI not equal to <<0>> on the MSC FP interface.

7.1.12.1.1 FP to MSC direction

Upon receipt of specific information transferred over the DECT radio interface, the FP may perform an interworking resulting in a message whose DLCI indicates a SAPI not equal to <<0>>. The transfer of such a message is performed as for layer 3 (DCMAP) messages.

7.1.12.1.2 MSC to FP direction

Receipt of a layer 3 (DCMAP) message from the MSC with the DLCI indicating a SAPI not equal to <<0>> will cause one of the following actions:

- the sending of a FPMAP SAPI <<N>> REJECT message to the MSC. A cause information element is included; typical cause value is: <<FP not equipped>>;
- the access to a specific FP interworking function ensuring that the interworked message will be transmitted over the DECT radio interface using a DECT SAPI.

7.1.13 Internal handover

When the PP is moving within one DECT Location area, internal handovers are performed. The FP may optionally report to the MSC the location of the PP by sending a HANDOVER PERFORMED message including the Cell identifier information where the PP is currently roaming.

7.1.14 External handover

The external handover procedure, including Handover required indication, Handover resource allocation, and Handover execution, is described in ETS 300 370 [6].

7.1.15 Load indication

The Load indication procedure is identical with the load indication procedure as specified in ETS 300 590 [5] (GSM 08.08).

7.1.16 FPMAP error handling

The handling of abnormal events related to the FPAP header is identical to the handling of abnormal events related to the BSSAP header as specified in ETS 300 590 [5] (GSM 08.08). The BSSMAP error handling as specified in ETS 300 590 [5] (GSM 08.08) is applicable to the FPMAP procedures, FPMAP messages and FPMAP information elements with the following exceptions:

type of information elements:

- there is no transparent information element in the FPMAP.

appropriate error message:

- for BSSMAP messages, defined in ETS 300 590 [5] (GSM 08.08), and received by the FP but not defined as applicable on the A-interface according to subclause 7.2.1, CONFUSION is the appropriate error message.

7.2 Messages and coding

7.2.1 FPMAP messages on the A-interface

For the BSSMAP procedures, defined in ETS 300 590 [5] (GSM 08.08), and applicable according to subclause 7.1, the following BSSMAP messages, which shall be called FPMAP messages, are applicable:

Assignment:

assignment request	(MSC -> FP);
assignment complete	(FP -> MSC);
assignment failure	(FP -> MSC).

Blocking:

block	(FP -> MSC);
blocking acknowledge	(MSC -> FP);
unblock	(FP -> MSC);
unblocking acknowledge	(MSC -> FP);
circuit group block	(FP -> MSC);
circuit group blocking acknowledge	(MSC -> FP);
circuit group unblock	(FP -> MSC);
circuit group unblocking acknowledge	(MSC -> FP).

Reset:

reset	(FP -> MSC; MSC -> FP);
reset acknowledge	(FP -> MSC; MSC -> FP).

Release:	
clear request	(FP -> MSC);
clear command	(MSC -> FP);
clear complete	(FP -> MSC).
Paging:	
paging	(MSC -> FP).
Flow control:	
overload	(FP -> MSC; MSC -> FP).
Cipher mode control:	
cipher mode command	(MSC -> FP);
cipher mode complete	(FP -> MSC);
cipher mode reject	(FP -> MSC).
Trace invocation:	
MSC invoke trace	(MSC -> FP).
Initial PP message:	
complete layer 3 information	(FP -> MSC).
Data link control SAPI not equal to 0:	
SAPI "N" Reject	(FP -> MSC).
Reset circuit:	
reset circuit	(FP -> MSC; MSC -> FP);
reset circuit acknowledge	(FP -> MSC; MSC -> FP).
Internal handover:	
handover performed	(FP -> MSC).
External handover:	
handover required	(FP -> MSC);
handover required reject	(MSC -> FP);
handover request	(MSC -> FP);
handover request acknowledge	(FP -> MSC);
handover command	(MSC -> FP);
handover detect	(FP -> MSC);
handover complete	(FP -> MSC);
handover failure	(FP -> MSC).
Load indication:	
load indication	(FP -> MSC; MSC -> FP)
Error handling:	
confusion	(FP -> MSC; MSC -> FP);
unequipped circuit	(FP -> MSC; MSC -> FP).

All other BSSMAP messages related to these procedures shall be treated as specified in subclause 7.3.

7.2.2 FPMAP information elements on the A-interface

For the BSSMAP messages, defined in ETS 300 590 [5] (GSM 08.08), and applicable according to subclause 7.2.1, the corresponding message type information elements plus the following BSSMAP information elements, which shall be called FPMAP information elements, are applicable:

Assignment request:

all information elements.

Assignment complete:

chosen channel.

Assignment failure:

cause.

Block:

all information elements.

Blocking acknowledge:

all information elements.

Unblock:

all information elements.

Unblocking acknowledge:

all information elements.

Circuit group block:

all information elements.

Circuit group blocking acknowledge:

all information elements.

Circuit group unblock:

all information elements.

Circuit group unblocking acknowledge:

all information elements.

Reset:

all information elements.

Reset acknowledge:

all information elements (see note).

Clear Request:

all information elements.

Clear Command:

all information elements.

Clear Complete:

all information elements (see note).

Paging:

all information elements.

Overload:

cause.

Cipher mode command:

all information elements.

Cipher mode complete:
all information elements.

Cipher mode reject:
all information elements.

MSC invoke trace:
all information elements.

Complete layer 3 information:
cell identifier;
layer 3 information.

SAPI "N" Reject:
all information elements.

Reset circuit:
all information elements.

Reset circuit acknowledge:
all information elements.

Handover performed:
cause;
cell identifier.

Handover request:
all information elements.

Handover request acknowledge:
layer 3 information;
chosen channel;
chosen encryption element.

Handover required:
cause;
response request;
cell identifier list;
current channel.

Handover required reject:
all information elements.

Handover command:
all information elements.

Handover complete:
no information elements.

Handover detect:
all information elements.

Handover failure:
cause.

Load indication:
all information elements.

Confusion:
all information elements.

Unequipped circuit:
all information elements.

NOTE: Except the message type, this message does not contain any information element.

7.2.3 FPMAP information element coding values on the A-interface

For the BSSMAP messages, defined in ETS 300 590 [5] (GSM 08.08), applicable according to subclause 7.2.1 and for their information elements applicable according to subclause 7.2.2, all BSSMAP information element coding values are applicable unless otherwise specified in subclause 7.3.

7.3 Exceptions for FPMAP procedures, message contents and information element coding values used on the A-interface

This subclause specifies the exceptions for the FPMAP procedures, message contents and information element coding defined in subclauses 7.1 and 7.2.

By an exception for FPMAP procedure it is meant that one or several correlated messages shall not be transferred on the A-interface.

By an exception for FPMAP message it is meant that one or several correlated information elements shall not be included in the message when transferred on the A-interface.

By an exception for FPMAP information element it is meant that one or several information element coding values defined in ETS 300 590 [5] (GSM 08.08) are considered as "reserved" or "spare" by the receiving entity.

7.3.1 FPMAP procedures, exceptions to BSSMAP procedures

For the FPMAP procedures defined in subclause 7.1, the following exception is valid:

Trace Invocation:

BSC invoke trace (FP -> MSC; MSC -> FP).

If however received by the FP, the message shall be treated as a message with an unrecognizable message type.

7.3.2 FPMAP messages, exceptions to BSSMAP procedures

For the FPMAP messages transferred on the A-interface and defined in subclause 7.2.1, the following exceptions to the descriptions in ETS 300 590 [5] (GSM 08.08) are valid:

Assignment complete:

- excluded information elements:
 - RR cause;
 - cell identifier;
 - circuit pool.

Assignment failure:

- excluded information element:
 - RR cause;
 - circuit pool;
 - switch circuit pool.

Overload:

- excluded information element:
 - cell identifier.

Complete layer 3 information:

- excluded information element:
chosen channel.

Handover performed:

- excluded information element:
chosen channel;
chosen encryption algorithm.

Handover request acknowledge:

- excluded information elements:
circuit pool.

Handover required:

- excluded information elements:
circuit pool list.

Handover complete:

- excluded information elements:
RR cause.

Handover failure:

- excluded information elements:
RR cause;
circuit pool;
circuit pool list.

If however transferred on A-interface, the information element shall be treated by the receiving entity as specified in the ETS 300 590 [5] (GSM 08.08).

7.3.3 FPMAP information element coding

For the FPMAP information elements transferred on the A-interface in FPMAP messages and applicable according to subclause 7.2.2, the following exceptions to the coding values defined in ETS 300 590 [5] (GSM 08.08) are valid:

Message type:

- excluded coding values:
BSC invoke trace.

If however received by the FP, the message type shall be treated as an unrecognizable message type.

Cause:

- excluded coding values:
radio interface message failure;
radio interface failure;
uplink quality;
uplink strength;
downlink quality;
downlink strength;
distance;
response to MSC invocation;
directed retry;
ms not equipped;
requested transcoding/rate unavailable;
circuit pool mismatch;
switch circuit pool.

The corresponding cause values shall be considered by the receiving entity as valid "reserved for national use".

Channel type:

- excluded coding values:
 - for channel rate and type when speech or data or signalling:
half rate TCH channel Lm.

The corresponding channel type values shall be considered by the receiving entity as "reserved".

- for further study:
 - speech/data indicator:
data.
 - speech encoding algorithm/data rate + transparency indicator when data:
all coding values.

The corresponding channel type values shall be considered by the receiving entity as "reserved".

Chosen channel:

- excluded coding values:
half rate TCH.

The corresponding chosen channel values may be considered by the receiving entity as "valid".

7.4 FPMAP timers in the FPMAP procedures

For the BSSMAP procedures, defined in ETS 300 590 [5] (GSM 08.08) and applicable according to subclause 7.1, the corresponding timers, defined in ETS 300 590 [5] (GSM 08.08), are applicable.

Annex A (normative): FPMAP procedures associated with BSSMAP procedures

This annex gives the equivalent FPMAP procedure, if any, associated to a BSSMAP procedure. If none, the entity behaviour depends on the entity (MSC or FP).

BSSMAP Procedures	FPMAP Procedures
Assignment	Assignment
Blocking	Blocking
Resource indication	(see note 3)
Reset	Reset
Handover required indication	Handover required indication
Handover resource allocation	Handover resource allocation
Handover execution	Handover execution
Handover candidate enquiry	(see note 3)
Release	Release
Paging	Paging
Flow control	Flow control
Classmark handling	(see note 3)
Cipher mode control	Cipher mode control
Trace invocation	Trace invocation (see note 1)
Initial MS message	Initial PP message
Queuing indication	(see note 3)
Data link control SAPI not equal to 0	Data link control SAPI not equal to 0
Reset circuit	Reset circuit
Internal Handover (see note 4)	Internal Handover
Load indication	Load indication
Error handling (see note 2)	Error handling
<p>NOTE 1: This FPMAP procedure is only a subset of the equivalent BSSMAP procedure.</p> <p>NOTE 2: The handling of abnormal events in ETS 300 590 [5] (GSM 08.08) is not defined as a procedure.</p> <p>NOTE 3: The handling of the procedure depends on the receiving entity. This handling can be either to apply the corresponding error handling subclause of ETS 300 590 [5] (GSM 08.08) or to apply the error handling on messages whose types are non-existent.</p> <p>NOTE 4: Both Internal Intra-Cell and Internal Inter-Cell Handover are considered in this specification as Internal Handover procedure.</p>	

Annex B (normative): FPMAP message per FPMAP procedure associated with BSSMAP message

This annex gives the equivalent FPMAP message per FPMAP procedure, if any, associated to a BSSMAP message. If none, the entity behaviour depends on the entity (MSC or FP).

BSSMAP Procedures	FPMAP Procedures
Assignment	Assignment
Assignment request	Assignment request
Assignment complete	Assignment complete
Assignment failure	Assignment failure
Blocking	Blocking
Block	Block
Blocking acknowledge	Blocking acknowledge
Circuit group block	Circuit group block
Circuit group blocking acknowledge	Circuit group blocking acknowledge
Unblock	Unblock
Unblocking acknowledge	Unblocking acknowledge
Circuit group unblock	Circuit group unblock
Circuit group unblocking acknowledge	Circuit group unblocking acknowledge
Resource indication	-
Resource indication	(see notes 2 and 1)
Resource request	(see notes 1 and 2)
Reset	Reset
Reset	Reset
Reset acknowledge	Reset acknowledge
Handover required indication	Handover required indication
Handover required	Handover required
Handover required reject	Handover required reject
Handover resource allocation	Handover resource allocation
Handover request	Handover request
Handover acknowledge	Handover acknowledge
Handover failure	Handover failure
Handover execution	Handover execution
Handover command	Handover command
Handover failure	Handover failure
Handover detect	Handover detect
Handover complete	Handover complete
Release	Release
Clear request	Clear request
Clear command	Clear command
Clear complete	Clear complete
Paging	Paging
Paging	Paging
Flow control	Flow control
Overload	Overload

Classmark handling	Classmark handling
Classmark request	(see note 1)
Classmark update	(see note 3)

Cipher mode control	Cipher mode control
Cipher mode command	Cipher mode command
Cipher mode complete	Cipher mode complete
Cipher mode reject	Cipher mode reject

Trace invocation	Trace invocation
MSC invoke trace	MSC invoke trace
BSC invoke trace	(see note 5)

Initial MS message	Initial PP message
Complete layer 3 information	Complete layer 3 information

Queuing indication	-
Queuing indication	(see note 2)

Data link control SAPI not equal to 0	Data link control SAPI not equal to 0
SAPI "n" reject	SAPI "n" reject

Reset Circuit	Reset Circuit
Reset circuit	Reset circuit
Reset circuit acknowledge	Reset circuit acknowledge

Internal Handover	Internal Handover
Assignment complete	(see note 6)
Handover performed	Handover performed

Load indication	Load indication
Load indication	Load indication

Error handling (see note 4)	Error handling
Confusion	Confusion
Unequipped circuit	Unequipped circuit

NOTE 1: If received by the FP transferred on the A-interface, this message shall either be ignored or rejected using CONFUSION message.

NOTE 2: The message shall not be sent on the A-interface.

NOTE 3: This message shall not be sent by the FP and if received by the FP, it shall be ignored.

NOTE 4: The handling of abnormal events in ETS 300 590 [5] (GSM 08.08) is not defined as a procedure.

NOTE 5: This message shall not be sent on the A-interface by the FP and if received by the FP, this message shall either be ignored or rejected using CONFUSION message.

NOTE 6: DECT handover procedure cannot be triggered by the FPMAP assignment procedure. Hence, this message is not applicable in the scope of Internal Handover procedure.

Annex C (informative): Bibliography

- ETR 022 (1991): "Advanced Testing Methods (ATM); Vocabulary of terms used in communication protocols conformance testing (2001)".
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- ETS 300 555: "European digital cellular telecommunications system (Phase 2); Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification (GSM 04.06)".

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