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TETRAPOL FORUM

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Foreword

This document is the Publicly Available Specification (PAS) of the TETRAPOL land mobile radio system, which shall provide digital narrow band voice, messaging, and data services. Its main objective is to provide specifications dedicated to the more demanding PMR segment: the public safety. These specifications are also applicable to most PMR networks.

This PAS is a multipart document which consists of:

Part 1 General Network Design

Part 2 Radio Air interface

Part 3 Air Interface Protocol

Part 4 Gateway to X.400 MTA

Part 5 Interface to dispatch centre

Part 6 Line Connected Terminal interface

Part 7 Codec

Part 8 Radio conformance tests

Part 9 Air interface protocol conformance tests

Part 10 Inter System Interface

Part 11 Gateway to PABX, ISDN, PDN

Part 12 Network Management Centre interface

Part 13 User Data Terminal to System Terminal interface

Part 14 System Simulator

Part 15 Gateway to External Data Terminal

Part 16 Security

Part 17 Guide to TETRAPOL features

Part 18 Base station to Radio switch interface

Part 19 Stand Alone Dispatch Position interface

1. Scope

The TETRAPOL R6 interface to a dispatch centre is a network-to-network interface between one TETRAPOL switching and management infrastructure (SwMI) and one dispatch centre (DC).

R6 interface is split between R6-I1 route with its voice channels and its circuit related protocol at network layer, and R6-I3 route and its associated service control protocol at applicative layer, that complements the operations over R6-I1 between the SwMI and the dispatch centre.

The service control protocol of the R6-I3 and R6-I1 interfaces are described in this document.

This document corresponds to sub-part 5.4 of the TETRAPOL interface to a dispatch centre, which is divided into several sub-parts:

- Part 5.1 Technical requirements;
- Part 5.2 Speech Control protocol design on digital support interface
- Part 5.3 Speech related protocol design for R6-I1 analog interface
- Part 5.4 Service control protocol design for R6 interface
- Part 5.5 Service control messages for R6-I3 interface

This sub-part establishes the service control protocol between TETRAPOL side (including DAC and AG) and dispatch centre side (including DCS and DPS).

2. Normative references

This PAS 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.

[1] PAS 0001-1-1: "TETRAPOL Specifications; General Network Design; Reference Model".

[2] PAS 0001-5-1: "TETRAPOL Specifications; Interface to dispatch centre; Technical requirements specifications."

[3] PAS 0001-5-2: "TETRAPOL Specifications; Interface to dispatch centre; Speech Control Protocol Design on digital support".

[4] PAS 0001-12: "TETRAPOL specifications; Network management centre interface"

[5] PAS 0001-3: "TETRAPOL specifications; Air Interface Applicative protocol"

[6] ITU-T Recommendation Q.120x series.

[7] PAS 0001-5-3: "TETRAPOL Specifications; Interface to dispatch centre; Technical Specifications of R6-i1 analog interface".

[8] PAS 0001-5-5: "TETRAPOL Specifications; Interface to dispatch centre; Service control messages ".

3. Definitions, symbols and abbreviations

3.1 Definitions

The definitions from the dispatch centre technical requirements [2] apply, including the following definitions:

Access gate (AG): Functional entity in the TETRAPOL SwMI, radio connected or line connected, that supplies voice and signalling facilities to the dispatch centre.

AG-trunk: A set of access gates. All AGs of a trunk belong to the same DC-organization and are linked to the same AH. All AGs of one trunk support the same types of communications.

Access handler (AH): Functional entity in the TETRAPOL SwMI, regrouping a set of trunks that belong to the same line connected or radio connected « base station » of the dispatch centre.

Dispatch Access Controller (DAC): Functional entity within the TETRAPOL system that acts as a Service Control Point (SCP) [6] for the dispatch centre.

Dispatch Centre (DC): The dispatch centre shall include a dispatch control server (DCS) and a dispatch position switch (DPS) which connects a number of dispatch positions (DPs) to the TETRAPOL network. The dispatch centre provides the dispatchers from one or several DC-organizations with incoming and outgoing TETRAPOL voice services and system monitoring. It may also supply call centre facilities, e.g. automatic call distribution, that are however out of the scope of the TETRAPOL system.

DC subscriber: A subscriber of the dispatch centre that uses a dispatch position

Dispatch control server (DCS): Functional entity within the dispatch centre that carries control signalling and interface related information between the DAC and the DC.

Dispatch Position Switch (DPS): Call control functional entity within the dispatch centre that supports voice calls over the R6-I1 interface to the TETRAPOL SwMI.

Incoming call: Call from TETRAPOL to DC

Operational group: Group of TETRAPOL subscribers that share a certain right to participate in a group communication.

DC-Organization: A DC-organization consists of a set of trunks. The DC-organization serves for administrative purposes in the dispatch centre.

Outgoing call: Call from DC to TETRAPOL

System: The TETRAPOL system is composed of the large area fixed infrastructure (SwMI) called network and of the system terminals allowing user access to the available services.

System Terminal: Service acces reference point provided to a user by the system; System terminals (ST) are radio terminals (RT) or line connected terminals (LCT).

Switching and Management Infrastructure (SwMI): The SwMI shall be a sub-system of the TETRAPOL network. It includes two sub-systems: the base station and the radio switch (RSW) network. The SwMI also includes one or several DACs, the operation and maintenance centre (OMC) and the key management centre (KMC). OMC and KMC are outside the scope of the present specification.

TETRAPOL subscriber: A subscriber of TETRAPOL system that uses a System Terminal

3.2 Symbols

Not applicable.

3.3 Abbreviations

The abbreviations from document [2] apply, including the following abbreviations:

AG	Access gate at SwMI side of the R6 interface
AH	Access handler in the SwMI
BOCH	Broadcast Open CHannel
DAC	Dispatch access control functional entity in the SwMI
DC	Dispatch centre
DCS	Dispatch centre server functional entity in the DC
DPS	Dispatch position switch functional entity in the DC
EMOCH	Emergency Multisite Open CHannel
ESOCH	Emergency Single site Open CHannel
FBM	Fall Back mode
MOCH	Multisite Open CHannel
PDU	Protocol data unit
PTT	Push-to-talk
R6	Reference point for the TETRAPOL SwMI-Dispatch centre interface
RD	Receive Detection
SCF	Service control functional entity
SDU	Service data unit
SMS	Short Message Service
SwMI	TETRAPOL SWitching and Management Infrastructure
TI	Transmit indication

4. Description of the interface between TETRAPOL and DC

4.1 Interface functional model

The functional model shall consist of the following functional entities:

AG : Access gate

DAC : Dispatch Access Controller

DCS : Dispatch Control Server

DPS : Dispatch Position Switch

The allocation of the functional entities to physical equipments shall be as follows:

- DAC and AG shall be located in the TETRAPOL SwMI;
- DCS and DPS shall be located in the dispatch centre.

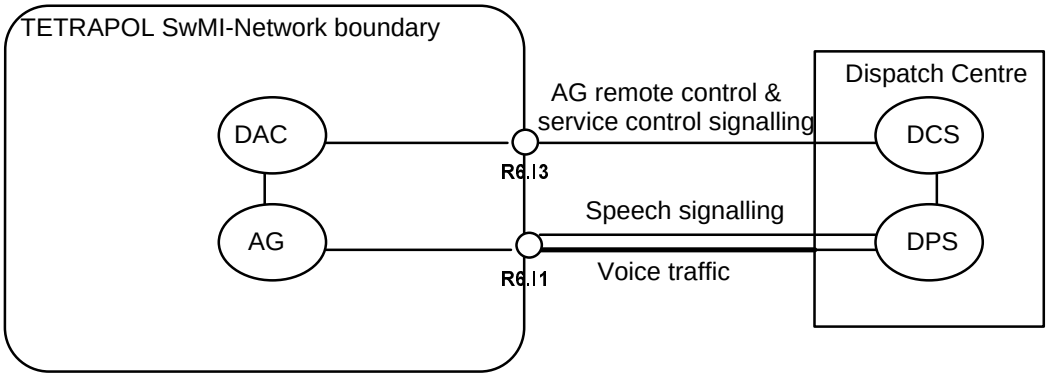

Figure 1: DC gateway

4.1.1 Interfaces between entities

The R6 reference point from the TETRAPOL reference model [1] is split between two logical routes and related interfaces:

- one dedicated to circuit mode speech transmission and related signalling between AG and DPS which is referenced as R6.I1. This circuit shall be on analog or digital interface.
- other dedicated to AG remote control and service control signalling, used for service control signalling at applicative layer between DAC and DCS which is referenced as R6.I3. This relies on a permanent TCP/IP connection.

The different information flows on R6-I1 and R6-I3 routes are correlated, as the flow over R6-I3 route complements the signalling flow over R6-I1 route.

During a call involving one or several TETRAPOL subscribers and one or several DC subscribers, there shall be only one AG involved.

The service control protocol over R6-I3 takes the following assumptions upon the R6-I1 interface:

- circuit mode voice transmission via analog or digital lines from each AG to the DPS and from the DPS to every AG.
- arbitration of push to talk requests between TETRAPOL users and DPS performed by the TETRAPOL SwMI.

4.1.2 AG roles

AG roles are:

- to deliver unciphered voice traffic and voice traffic signalling (PTT, TI , RD) on one R6-I1 interface to DPS on analog or digital lines.
- to provide DAC with control signalling from the TETRAPOL SwMI.
- to ask for processing of call control requests coming from the DC to the TETRAPOL SwMI.

4.1.3 DAC roles

The dispatch access controller (DAC) functional entity provides a service control function (SCF) within the TETRAPOL SwMI.

As a handler of SwMI interface, the DAC shall provide the DCS with a description of the abstract model managed at R6-I3 interface. The DAC shall act upon AG on behalf of the DCS. It shall request for initialization of AGs and provide the DCS with their availability state.

As a gateway from SwMI to DCS, the DAC shall route to the DCS information coming from the TETRAPOL services and from the SwMI.

As a gateway from DCS to SwMI, the DAC shall route call control requests from DCS to TETRAPOL SwMI through designated AG.

As a concentrator for AG-related information flows, the DAC is assumed to provide one secured point-to-point transport service with one DCS, regrouping data flows of all AGs.

As a gatekeeper of TETRAPOL SwMI, the DAC shall control partitioning parameters of calls. Partitioning parameters are operational groups (OG) that share the right to participate to a group communication.

4.1.4 DCS roles

The Dispatch Control Server (DCS) functional entity provides a service control function (SCF) within the DC.

As a resource manager, DCS shall handle the state of resources and communications attributed to these resources. As though, DCS may optionally provide DPS with information necessary to connect voice circuit between AG and DC subscriber.

As a gateway from TETRAPOL SwMI to DC subscriber, DCS shall route information coming from the DAC to the DC subscribers.

As a request handler, DCS shall accept call control requests coming from DC subscribers and attribute channel resources (AG). The DCS shall be in charge of providing the DC with the characteristics of the R6-I1 interface and related AG, when the DPS sets up an outgoing call.

4.1.5 DPS roles

The DPS functional entity of the DC shall handle the call control over the R6-I1 interface and the switching of calls and services in DC system.

DPS role is to manage the connection of the speech circuit between one AG and one or several DC subscribers.

DPS role is also to transmit speech-signalling coming from AGs to the DC subscribers.

4.2 Information flows

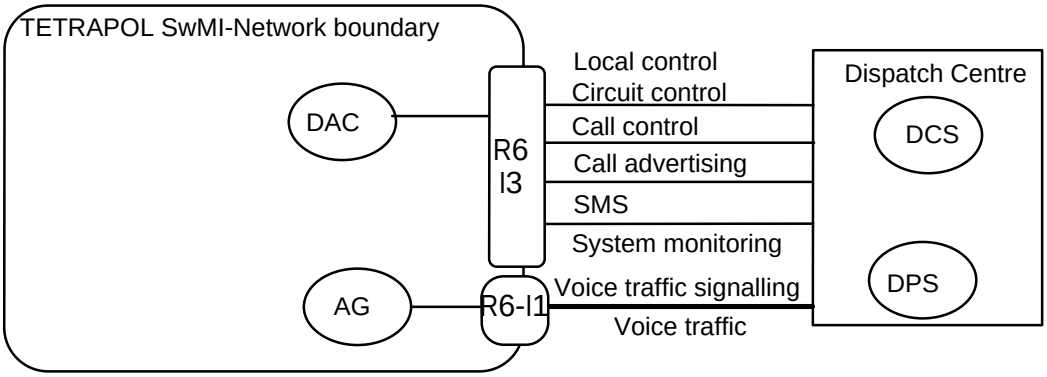

Figure 2 Information flows over R6 interface

The different information flows on R6-I1 and R6-I3 routes are correlated, as the flow over R6-I3 route complements the signalling flow over R6-I1 route.

The information that flows between the SwMI and the DC over the R6 interface shall be split between the following different flows.

4.2.1 Local control

Signalling related to local control shall flow over R6-I3 interface. It allows management of predefined objects of the interface in order to split access gates to TETRAPOL system into homogeneous subsets. They shall be delivered to DCS on specific request.

For objects of this model corresponding to physical resources (AG and AH), states of these resources are available through local control flow. They shall be delivered spontaneously from DAC to DCS on update of these states.

4.2.2 Circuit control

Signalling related to circuit control shall flow over R6-I3 interface. It allows management of access gates to TETRAPOL system. These are requests from DCS that modify behaviour of AG at TETRAPOL system interface.

Modifications requested through this flow are not related to a specific communication.

The AG must be in a "registered" state so that a request is taken into account. It may be busy or not.

4.2.3 System monitoring

Signalling related to system monitoring shall flow over R6-I3 interface. It gives informations about accessibility of group communications through R6-I3 interface.

These informations shall be sent spontaneously to DCS on update from TETRAPOL system. They shall also be accessible on specific request from DCS to DAC.

4.2.4 Call control

Signalling related to call control shall flow over R6-I3 interface. It allows access to voice services either requested from DC side or from TETRAPOL side.

From DC side, basic service for voice is setup, release, participation, and withdrawal of voice communications. Supplementary services may be available.

Requests from DCS for basic services shall use a free AG to be taken into account by TETRAPOL system (except for withdrawal, which applies on a AG busy in a communication).

Request of supplementary services shall apply on a communication in which the designated AG participates.

From TETRAPOL side, this may be notification of incoming private communications, or some signalling (emergency, overload).

4.2.5 Data services

The only one data service available at R6 interface is SMS (Short Message Service). It allows to send or receive predefined messages, or messages with text of a limited size. SMS service shall flow over R6-I3 interface.

4.2.6 Call advertising

Signalling related to call advertising shall flow over R6-I3 interface.

This is a spontaneous flow of information coming from TETRAPOL side, on noticeable events concerning voice communications accessible at interface. These are activation and desactivation of voice communications, and notifications of emergency from TETRAPOL subscribers.

4.2.7 Voice traffic

Voice is carried on an established circuit between AG and DPS on R6-I1 interface, using dedicated wires for analog interface, or a single B channel for digital interface.

Voice traffic is in half duplex mode.

Voice is carried in clear mode over R6-I1 interface.

A circuit mode voice transmission exist between each AG and the DPS.

4.2.8 Voice traffic signalling

Signalling related to voice traffic shall be sent over R6-I1 interface with dedicated wires for analog interface, or using FACILITY feature on D-channel for digital interface.

Signalling transmitted on analog interface are RD: Receive Detection, PTT: Push to Talk, TI : Transmit Indication.

For a digital interface, TPI (Talking Party Identity inside TETRAPOL) signal is also transmitted as well as the previous mentioned signals.

Push to talk request/release from the DPS to an AG and receive detection activation/deactivation signalling from each AG to the DPS shall flow over R6-I1 interface, with arbitration of push to talk requests performed by the SwMI.

Some voice traffic signalling may also flow on R6-I3 interface. These are Transmit Indications and TPI indications. PTT indications signalling that a PTT request or release on an AG has been asked over R6-I1 interface shall flow on R6-I3 interface.

4.3 Objects management at R6 interface

4.3.1 Objects management at R6-I1 interface

For each call over the R6-I1 interface, the logical access point instance at the SwMI side is referred to as an access gate (AG) instance. As there is one physical link between DPS and every AG, there is an implicit addressing over R6-I1 interface.

4.3.2 Objects management at R6-I3 interface

4.3.2.1 Configuration of objects constituting the interface

An abstract model of objects is designed at R6-I3 interface. This is used to split access gates resources into homogeneous subsets.

Each of these objects is identified by a unique identifier in one R6 interface. The unique identification of an object in a R6 interface is composed of (type of object, number in type).

No modifications of this model are possible through R6 interface. It is handled statically by TETRAPOL side. It is updatable only by configuration of TETRAPOL system.

One exception exist for radio AG. It is possible to ask for registration of radio AG to several BS (if they are under the coverage of these BS).

Local control flow of information may be used by DCS to get informations on this model.

Circuit control flow of information may be used by DCS to modify behaviour of the AGs.

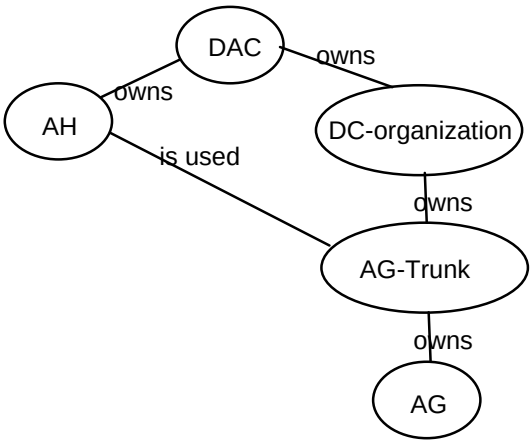

Figure 3: configuration model of R6 interface

The **DAC** shall merge a set of resources offering a unique signalling and call control R6-I3 interface. There is one and only one instance of DAC object for one R6-I3 interface. A DC may be connected to several R6 interfaces (through several DAC).

The **Access Handler** (AH) shall merge a set of resources defining a routing direction to TETRAPOL SwMI. AH regroups a set of AG trunks that belong to the same LABS or radio BS linked to the DC.

AHs of one R6 interface may belong to several BNs.

DCS may know through this AH if a routing direction to TETRAPOL system is in a fallback mode.

There may be at least one AH defined. No maximum limit exist.

DC organization shall merge a set of resources for DC internal needs. This is worth only inside DC.

A DC organization may hold one or several AG trunks belonging to one or several AH.

Through this DC_organization, DCS may know which sources of OG may be delivered to the AG-trunks attached to it.

There may be at least one DC_organization defined. No maximum limit is defined.

AG trunk shall merge a set of AG that may be used by the DC for particular needs. An AG trunk may belong to one and only one DC organization and is linked to one and only one AH. Partitioning parameters are controlled through AG trunk on R6-I3 interface.

Trunks of AG are not known by TETRAPOL subscribers in the TETRAPOL addressing plan. Mapping of trunks of AG on TETRAPOL addressing plan is out of the scope of this document.

All AGs of one AG trunk shall support the same types of communications.

There may be at least one AG-trunk for a DC-organization. No maximum limit exist.

AG shall be the elementary resource managed by the DCS to access to the TETRAPOL system. An AG is attached to one and only one AG-trunk.

A state of registration and of forward of the AG is available for the DCS.

Two different configurations of AG behaviour are available through R6 interface. Differences concern access rights for group communications and behaviour of the AG on incoming.

- AG (terminal). Access rights of each AG are considered individually as if they were system terminals. A maximum of one AG may be attached to a trunk with AG terminal.
- AG (trunk). Access rights of every AG are gathered in the AG-trunk and access rights to communications are granted for all AGs of the AG-trunk. There may be any number of AGs (0 to more than one) attached to this kind of AG-trunks.

If there is no AG in an AG-trunk, no services will be offered through this AG-trunk.

4.3.2.2 Model of TETRAPOL objects for R6 interface

Hereafter is a simplified object model of R6 interface. These are the objects of the TETRAPOL system used at R6 interface.

System monitoring flow of information may be used by DCS to get informations on this model (group communications, coverages and related OGs).

Call control flow of information may be used by DAC and DCS to allow access to voice services using these objects.

Call advertising and Voice traffic signalling flows of information may be used by DCS to get informations on this model (activation and deactivation of group communications, TPI of subscribers).

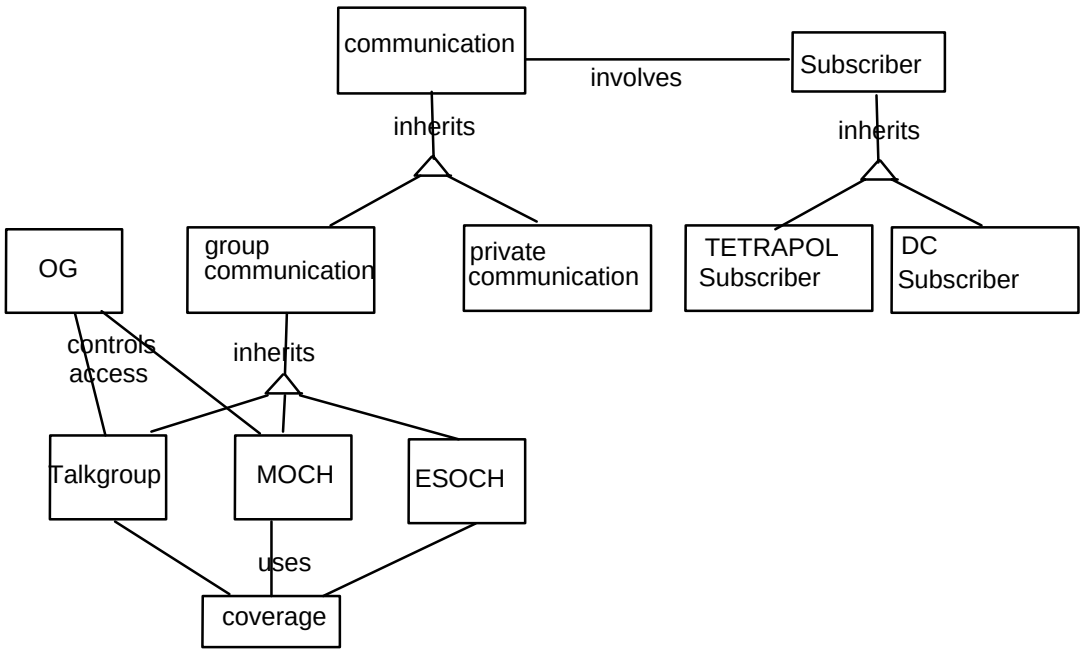

Figure 4: TETRAPOL model of R6 interface

4.3.2.2.1 TETRAPOL subscriber

Over R6 interface, TETRAPOL subscribers shall be individually identified in the TETRAPOL addressing plan.

Calling party address, called party address and talking party address are associated, in the appropriate messages, to incoming and outgoing calls to allow the identification of the TETRAPOL subscribers.

4.3.2.2.2 DC subscriber

Over R6 interface, DC subscribers are not individually identified. A TETRAPOL system does not know addressing plan inside DC. Thus talking party identification applies only to TETRAPOL subscribers.

Nevertheless, it shall be possible for private call setup and some supplementary services on private calls that TETRAPOL system provides a called address in DC addressing plan. This is not interpreted by TETRAPOL but transmitted transparently from TETRAPOL to DC.

4.3.2.2.3 Group communication

A group communication is addressed over R6 interface with one of the following way according to its type.

- a **MOCH identifier** for a multisite open channel (MOCH), a crisis open channel (EMOCH) or a broadcast open channel (BOCH). Talkgroup merging communications are also identified through a MOCH identifier. Several OG may be allocated to these group communications, and are used for access control.
- an **OG identifier** for a talkgroup. The coverage (COV identifier) associated to the OG shall give a full identification of a talkgroup. Only one OG (the one used for identification) grants access to a talkgroup.
- a **Cell identifier** for an emergency single site open channel (ESOCH). It is the identification of the radio cell in which the emergency communication has been initiated. No OG are associated to emergency open channel. No access control is done for these communications.

Identifications listed above are permanent and are significant whatever use is done at R6 interface. In order to be used, these identifications used at R6 interface shall be coherent with those defined inside TETRAPOL system.

4.3.2.2.4 Private communication

Private communications in which DC can participate are those initiated by DC or addressed to it. DC may also participate (by intrusion) into private communications between TETRAPOL subscribers. DC may not participate to private communications between PABX and a TETRAPOL subscriber.

There is no identification of a private call.

When initiated from TETRAPOL, calling and called party are delivered at R6 interface. In order that DC participates into a private call, an AG shall be allocated to the private call. As this AG is allocated, identification of the AG and a call reference dedicated to one private call shall be used to address the private call.

When initiated from DC, only called parties are to be provided. Identification of the private call shall be done as for previous case.

5. Protocol over R6 interface

Objective of this clause is to describe dynamic aspects of R6 interface. It includes the way to get the interface operational, and protocols to be used after it has reached this operational state.

5.1 Requirements on the TETRAPOL SwMI

5.1.1 Interoperability requirements

All AGs from a trunk of AGs shall manage identical features regarding their ciphering capabilities and behaviours regarding incoming calls from TETRAPOL.

5.2 Requirements to the Dispatch Centre

5.2.1 Allocation of DC functional capabilities to DPS and DCS

There shall be no assumption on the dispatch centre architecture. The protocol over R6 takes no assumption regarding any service node capability or any intelligent capability of the DC.

There shall be a functional entity in the DC that is the master source for selecting a free AG for a new call control transaction: Upon analysis of the requested service or analysis of the called party address, this functional entity selects any available AG from an ad-hoc trunk, or selects a specific AG, and requests the call to be routed through that AG and to be switched to a relevant dispatcher.

5.3 Compatibility rules

R6-I3 interface is designed to be upward compatible. This means that services offered in a version of the interface continue to be assumed the same way in highest versions of interface.

It is requested that version of interface supported by the DAC is higher or equal than the one supported by DCS.

It is not requested that a DCS supporting a higher version of interface is connected to DAC. If that case occurs, DAC should release connection over R6-I3 interface.

If a service requested by a DCS is not supported by a DAC, an error message shall be sent to DCS as a reply.

If a spontaneous delivery of information not supported by a DCS is sent by a DAC, the information shall be ignored by the DCS with no error.

5.4 Initialisation of R6 interface

Each functional entity of the R6 interface has its own sequence of initialization. As there is no checkpoint requested for a sequence initialization, it is each functional entity responsability to try (or to accept) connection only when it is ready to offer services. The following clause precises services that shall be available when connection is established.

5.4.1 Initialization of R6-I1 interface

One semi permanent circuit is established between DPS and every AG. Semi permanent means that it has to be established once and that it is never released while one of the extremities is not reset.

AG shall spontaneously try to register to the TETRAPOL SwMI.

It is not requested that specific services are available over R6-I1 interface in order that connection is established.

Should a loss of registration of the AG to TETRAPOL system occur, connection over R6-I1 interface is kept.

Should a release of AG-DAC connection occur, connection over R6-I1 interface is kept.

Should a release of DPS-DCS connection occur, connection over R6-I1 interface is kept.

Should a release of DPS-DC Subscriber connection occur, connection over R6-I1 interface is kept.

5.4.2 Initialization of R6-I3 interface

One TCP/IP connection is established between DAC and DCS. This connection is permanent. DAC acts as a server and waits for DCS connection.

Following services are requested from DAC before it accepts connection:
- DAC shall know a definition of the model of the R6-I3 interface.
- DAC shall know state of availability of each AG and AH declared in the R6-I3 model definition
- DAC shall have finished its initialization procedure with every accessible AG of the interface.

Before DCS requests for connection, it must be able to:
- accept exchange of interface version

Once R6-I3 initialization interface has ended, following flows of informations may be exchanged over R6-I3 interface:
- Local control flow in order that DCS gets the static configuration managed by the DAC and knows the states of availability of the access gates to TETRAPOL system.
- Circuit control flow in order to manage behaviour of AGs
- Call control flow for private communications.
- System monitoring flow in order that DCS knows the accessible group communications and coverages.

After these steps are completed, DCS is able to know the state of availability of R6 interface, and may propose services inside DC offered through call control for group communications, call advertising, voice traffic, voice traffic signalling and SMS flows.

5.5 Local control

5.5.1 Negotiation of the interface version

Negotiating the interface version shall be the first transaction between DCS and DAC upon DAC-DCS connection.

Upon the DCS connecting the DAC, DCS_INTERFACE_REQ shall be sent to the DAC indicating the protocol version preferred by the DCS.

The DAC shall provide in DAC_INTERFACE_IND the version of R6 interface to be adopted.

- This is the version proposed by the DCS if this version number is lower or equal to the version managed by the DAC.
- This is the highest version managed by the DAC if DCS version is higher.

If either DAC or DCS is not able to manage the version of interface, it shall release the TCP/IP connection.

Should the DCS not send the DCS_INTERFACE_REQ within a delay, the DAC shall release the TCP/IP connection.

Should the DAC not send the DAC_INTERFACE_IND within a delay, the DCS shall release the TCP/IP connection.

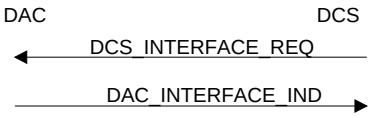

Figure 5: exchange of interface version

5.5.2 Keep alive mechanism between DAC and DCS

The exchange of messages DCS_INTERFACE_REQ sent by DCS to DAC followed by DAC_INTERFACE_IND sent by DAC to DCS is used as a "keep alive" mechanism between DAC and DCS. This means that these messages shall be regularly exchanged between DAC and DCS.

Should the DCS not send the DCS_INTERFACE_REQ within a delay (defined as T100+T101), the DAC shall release the TCP/IP connection.

Should the DAC not send the DAC_INTERFACE_IND in response to DCS_INTERFACE_REQ message within a delay (defined as T102), the DCS shall release the TCP/IP connection.

Then, if the connection has been released by one or the other side, it shall be re-established in a normal way.

No assumption shall be done on the state of the other side. Both extremities shall consider it as an initial start-up.

5.5.3 Configuration procedures

It is assumed that a default configuration is stored in the DAC before starting operating. After interface version negotiation, the DCS may request the DAC to provide the model of configuration objects.

Class of objects used to describe the interface are :

- DAC
- Access handler
- DC-Organization
- AG-Trunk
- Access gate

5.5.3.1 Procedures for requesting information on the configuration

The DCS may send several requests to get a full configuration information.

In order that DCS succeeds in configuration retrieval, it shall follow the hierarchy of objects described in Configuration of objects constituting the interface.

The mode of query of the configuration is:

- to identify an object by its object class and identification
- to identify a class of object just underneath in the hierarchy

There shall be one request for every query. The configuration requests shall be processed in sequence. The DCS shall not send a new request before the previous one has been answered.

Upon receiving DCS_CONFIGURATION_REQ query, the DAC either provides the appropriate configuration information in DAC_CONFIGURATION_IND or sends DAC_CONFIGURATION_ACK if the request for configuration information can not be processed.

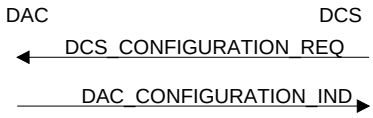

Figure 6: Information on configuration provided by the DAC upon request

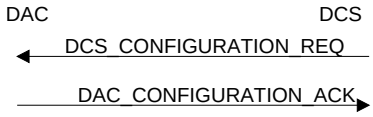

Figure 7: Failure to provide configuration information upon request

As the configuration is static, a case of failure may be due to a non respect of hierarchy of the model, or to a non respect of sequentiality.

5.5.3.2 Procedure for updating the configuration

This function is not mandatory at R6 interface.

It allows to update dynamically parameters of objects of the static configuration, or relationships between them. It has to be used when modification of static configuration is required for operational needs.

In this version of the interface, this is used to force registration of radio AG on different radio cells (different AH of the R6 interface) in order to be able to traffic on several radio cells. The only one possibility is to modify relationships between AG and their belonging AG-trunk.

This is possible using DCS_CONFIGURATION_UPDATE_REQ message from DCS.

Parameters of this message are:

- Sort class, sort identifier (Trunk_class, trunk_id) identifies the AG-trunk to which the AG shall be linked
- Object class (AG class) identifies the class of object concerned by modification
- a list of object configuration identification of the AG to be attached to the AG trunk. These AG must be radio AG, and they must be declared in the static configuration held by the DAC. The destination AG trunk must be declared in the static configuration and must be attached to a radio cell.

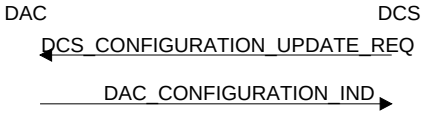

Figure 8: modification of configuration upon DCS request

If no error is detected, the DAC sends a DAC_CONFIGURATION_IND message to DCS. This message gives attributes and relationship with parent object of the modified objects in the configuration.

The AG shall then be forced to register in the new radio cell. They wil unregister from old radio call, register in the new one. If a group communication was installed on an AG, a confirmation of this installation is requested to DCS.

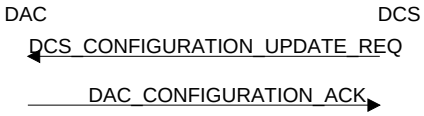

Figure 9: Failure to modify configuration upon DCS request

If an error is detected by the DAC, a DAC_CONFIGURATION_ACK message is sent to DCS. The request is globally rejected and the old attributes and relationships between objects are kept.

These modifications of configuration shall be kept by TETRAPOL even after resets of TETRAPOL entities (DAC and AG).

5.5.3.3 Procedure to inform the DCS of a modification of the configuration

Some of the objects of the static model correspond to physical objects (Access gates and Access handlers). As though, states of availability are managed by the TETRAPOL system and shall be delivered spontaneously to the DCS on modification.

This happens for an AG in the following cases:

- modification of its state of registration. An AG can be used by the DCS only when it is registered in the TETRAPOL system. Two states are managed in local control flow: AG registered or not registered. All possible cases of unworking mode of an AG are gathered in the state "not registered".

This happens for an AH in the following case:

- Entering or exiting from a fallback mode of a radio cell attached to an AH. Refer to clause on fallback mode for more informations on behaviour of the R6 interface.

Figure 10: DAC informs of a modification in the configuration

5.6 Circuit control

5.6.1 AG reset

The AG reset is a mandatory service at R6 interface. It may be send any when as soon as the AG is reachable.

It is used to restart one specific AG. Using this procedure implies a release of R6-I1 connection between AG and DPS, a release of connection of AG to DAC and a loss of registration of the AG to TETRAPOL system. Of course, if the AG was involved in a private communication, it is lost.

It is followed by a standard restart of the AG, and of the connections of the AG to its interfaces (R6-I1 interface, registration to TETRAPOL system, connection to DAC).

Using this procedure shall have following impacts on AG parameters:

- ongoing group or private communication is lost
- interdiction of incoming calls is lost (incoming calls are authorised consistently with configuration parameters)
- state of forwarding remains unchanged and host address is kept.
- PTT priority remains unchanged
- Set of key used for manual keying remains unchanged

So, after a reset, an AG shall be considered in a free state.

The DAC can signal a protocol error concerning an AG. In that case, it is recommended that the DCS reset the corresponding AG with the message DCS_AG_RESET:

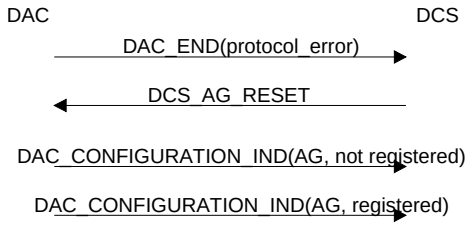

Figure 11: Protocol error

5.6.2 Reservation of radio AG for monitoring

This functionality is not mandatory at R6 interface. It is not available for line connected AG.

It may be needed to guarantee a delivery of system monitoring and call advertising flows if AG resource cannot manage call control flows at the same time as monitoring flows (typically for radio AG).

In this case, an AG has to be reserved for monitoring by both sides. By the DCS which should not use it for call control flows and data flows, and by TETRAPOL SwMI, which shall not use it for incoming calls.

One AG is needed for every Access handler managed at interface. DCS may choose the AG sending a DCS_CONFIG message on an AG.

Monitoring field of DCS_CONFIG message will indicate that the AG will be used for the purpose of monitoring. This means that this AG will provide the DCS with the monitoring flows defined for the trunk at DAC configuration.

Incoming calls field of DCS_CONFIG message may be used to forbid incoming private voice calls to this AG.

Data behaviour field of DCS_CONFIG message may be used to indicate whether SMS implicitly addressed to the DC may be received by this AG. It is requested that one AG by trunk which authorizes reception of SMS is defined for reception of SMS implicitly addressed.

If the monitoring AG is malfunctionning, spontaneous notification shall be sent from DAC to DCS with the state of the AG (message DAC_CONFIGURATION_IND). It is up to the DCS to choose another AG for monitoring in this case. During this phase, it shall be assumed by the DCS that some monitoring information may be lost.

The monitoring flows available at DAC configuration are those defined in monitoring field:

- activations and end of activations of group communications
- emergency notifications for group communications
- Overload and emergency signalling
- system monitoring messages

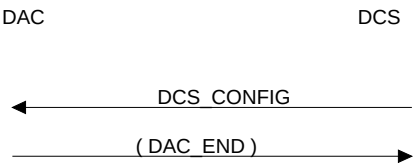

Figure 12: DCS requests for monitoring

5.6.3 Interdiction of incoming calls

In order to forbid presentation of incoming calls on some AG (so that they can be presented on other available resources), it is possible to request for interdiction of incoming calls from the DCS.

This request is valid until it is changed from DCS side or until AG resets. The request may concern only one AG or all the AG belonging to a trunk of AG.

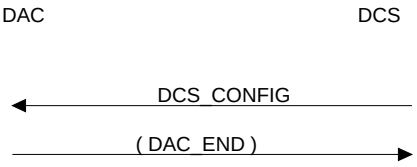

Figure 13: DCS requests for interdiction of incoming calls

There is no acknowledgement of this message if it is taken into account by TETRAPOL system. If an error is detected for at least an AG, a DAC_END message shall be sent to the DCS.

Cases of failure are:
- parameters of the request incorrect (AG unknown, bad formatted message)
- AG not reachable

If some AG are reachable and others are not, request will be taken into account for reachable AG and will not be for unreachable AG. List of unreachable AG is not known through DAC_END message, but through messages of circuit control flow.

5.6.4 PTT priority control

The PTT priority control is a mandatory service at R6 interface. It shall only be used for line connected AG. It may not be used for radio AG.

A default value of PTT priority shall be held by the AG. This default value is used if no modifications have been requested by the DCS.

The DCS may modify this default value of one AG at a time, sending the DCS_PTT_PRIORITY_CHANGE_REQ message. This modified value shall be kept by the AG, even after a reset. It shall remain valid till it is not modified by the DCS. It shall be valid for all communications that will use this AG. It shall be taken immediately into account by the AG.

There is no acknowledgement of this message if it is taken into account by TETRAPOL system. If an error is detected, a DAC_END message shall be sent to the DCS.

Cases of failure are:
- parameters of the request incorrect (AG unknown, bad PTT priority value)
- request to a radio AG
- AG not reachable

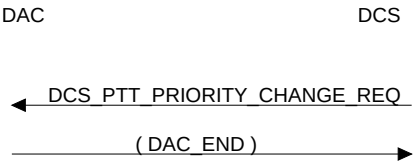

Figure 14: DCS changes PTT priority of an AG

5.6.5 Encryption control

The encryption control of an AG is an optional service at R6 interface. If not provided, manual keying facilities will not be available.

An encryption service over R6-I3 may provide manual keying facilities to the DCS as defined in TETRAPOL security services.

All communications using this AG shall be provided between the DAC and DCS is associated to DCS_SET_MANUAL_KEY, DCS_USE_MANUAL_KEY and DAC_CIPHERING_MODE and is further described in the related clause of TETRAPOL Security procedures.

The state of encryption is usually provided at setup (upon reception of DAC_CONNECT message of call control flow) or activation (upon reception of DAC_AG_ACTIVATION_IND message of call advertising flow) of the communication. When a DCS_USE_MANUAL_KEY is sent to DAC during an on going communication, DAC_CIPHERING_MODE indicates the state of encryption for the current on going communication.

No keys shall be transferred over R6 interface, keys modifiers only may be used.

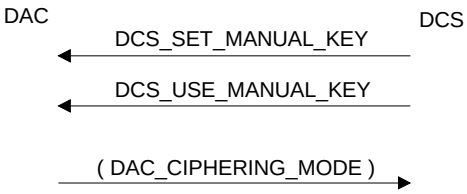

Figure 15: Manual keying sequence

5.6.6 Forward control

The forward control of an AG is an optional service at R6 interface.

It allows the DCS to forward and to cancel forward of an AG. This has to be done one AG by one AG of the R6 interface.

The AG shall not be involved into a communication. The state of forward of the AG is kept even after AG reset. It is valid until it is changed by another forward request.

Consequence for a forwarded AG is that it will not receive any more incoming private calls from TETRAPOL side.

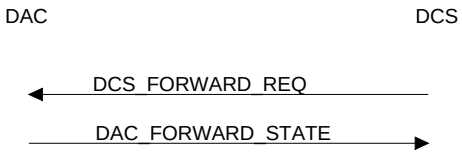

Figure 16: Forward or cancel forward request of an AG

DCS_FORWARD_REQ message parameters are:

- action requested (either forward or cancel forward)
- Host address in case of forward request. This must be an address of a TETRAPOL subscriber in TETRAPOL addressing plan

Reply is sent in DAC_FORWARD_STATE message. It gives the state of forward of the AG, the host address (if any), and the result of the request.

Causes of failure may be due to following causes:

- An inconsistent request
- An unknown or unreachable host address
- An AG in a busy state
- AG not reachable

5.7 System monitoring

5.7.1 Objectives

The system monitoring procedures is a mandatory service at R6 interface.

For communications partially managed outside TETRAPOL system, (talkgroups identified by external OGs), system monitoring procedures are optional.

It is used to exchange between DAC and DCS a knowledge of the group communications that are accessible over R6 interface. Accessible means that DC has got a routing direction (an access handler) to access these communications, that the communications are established and that the AG-trunk that will be used for access is granted (the AG-trunk has got OGs that grants access to the communications, and group communications are authorized through this trunk).

The access control is made by TETRAPOL system on participation request. As soon as informations on these group communications is delivered at R6 interface, they can be used by DCS in respect to access control rights.

Other group communications may be partially managed by TETRAPOL system and by the DC. These are talkgroups identified by external OGs. For these communications, prerequisites are necessary in order that they can be used at R6 interface, and access control must be done from DC side.

5.7.2 Procedures for group communications managed by TETRAPOL system

Some of these group communications are completely managed by TETRAPOL system. In this case, the delivery of accessible informations by TETRAPOL system to the DCS is mandatory.

These corresponds to following services:

- Multisite Open CHannel (MOCH)
- Broadcast Open CHannel (BOCH)
- Emergency Single Open CHannel (ESOCH)
- Emergency Multisite Open CHannel (EMOCH)
- Talkgroup merging communications
- Talkgroups not identified by an external OG

The DAC shall be able to spontaneously provide the DCS with information on state of these group communications. These notifications shall be delivered for each AG-trunk managed at R6-I3 interface.

The DCS may also request these informations over R6-I3 interface. On this specific request, DAC shall answer immediately to the request.

Access control to group communications made by the TETRAPOL system in call control flow shall be coherent with the delivered lists.

These notifications are grouped in three different messages:

- Available ESOCH in an AG-trunk with their attributes
- Available talkgroup in an AG-trunk with their attributes
- Available MOCH in an AG-trunk with their attributes. This list regroups MOCH, BOCH, EMOCH, talkgroup merging communications which are all identified the same way.

5.7.3 Procedures for group communications identified by external OGs

The management of these group communications identified by external OGs is optional on R6 interface.

These group communications are talkgroups identified by an external OG. These communications are defined in TETRAPOL system, and identified by an OG identifier and the related coverage identifier. As the definition of the access rights of the OG is not done inside TETRAPOL system, no access control to

these group communications may be made at R6 interface. So, it is DC role to do access control for these communications.

In order to be used at R6 interface, these external talkgroups shall be delivered by DCS to DAC at R6 interface.

In order to be sure that they can be used inside TETRAPOL system, DC must know if the coverage associated to the external talkgroup that will support the communication is accessible at R6 interface.

The DAC should be able to spontaneously provide the DCS with the accessible coverages. These notifications should be delivered for each AG-trunk managed at R6-I3 interface. As there is no access control from TETRAPOL on these communications, there is no filtering on the list of coverages accessible at interface.

The DCS may provide the DAC with a list of external OG for an AG-trunk over R6-I3 interface. This is a prerequisite in order that these external OGs may be used in call control flow.

The DCS may also request for coverages and for accessible OGs over R6-I3 interface. On this specific request, DAC should answer immediately to the request. If the request concerns OGs, all OGs of the AG -trunk (internal and external OGs) will be sent back in the reply.

System monitoring flow related to this external OG is:
- Accessible coverages for an AG-trunk

5.7.4 List transfer on DCS request

In order to get informations about accessible group communications at R6 interface, DC may request over R6-I3 interface for the list of accessible objects in an AG-trunk. This flow may be exchanged at R6 interface any when after negotiation of interface version has been completed.

One may notice that local control flow should have been completed in order that AG-trunk configuration is known from DC side (no control has to be done over R6 interface that local control flow has been completed).

The request from DCS uses DCS_SORTED_LIST_REQ message. It shall include a sort criterion including identification of the AG-trunk and identification of the class of object. A successful reply is sent using DAC_SORTED_LIST_IND message. All instances belonging to the AG-trunk corresponding to the sort criterion shall be sent in a successful reply.

The list sent in reply may be empty. A DAC_SORTED_LIST_IND message will be sent with no objects.

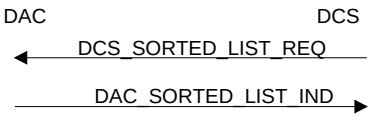

Figure 17: Successful request

An unsuccessful reply may be sent using DAC_SORTED_LIST_ACK message.

Possible causes of error are:

- bad parameters value
- request not supported
- unknown sort identifier

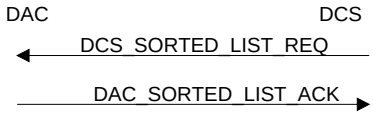

Figure 18: Unsuccessful request

5.7.5 Spontaneous list transfer from DAC to DCS

The modifications shall be notified to DCS at every update noticed by TETRAPOL system with no delay. They may be sent as soon as negotiation of the interface version is completed.

These modifications may be due to the following causes:

- Establishment or release of the communication
- Modification of the access rights of the AG belonging to an AG-trunk
- Loss of registration of an AG
- Fallback modes of the access handler

Transferred lists shall be exhaustive lists at every notification and shall supersede previous ones.

These notifications are delivered over R6-I3 interface using DAC_SORTED_LIST_IND message. The identification of the content of the sorted list is possible according to a sort criterion. It identifies the AG-trunk for which the list is delivered and the class of objects (ESOCH, Talkgroup, MOCH). No acknowledgement is required from DC side.

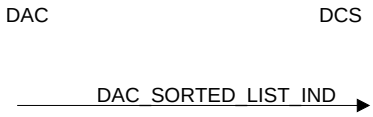

Figure 19: Spontaneous sorted list transfer from DAC

5.7.6 List delivery by DCS to DAC

The modifications shall be notified to DAC at every update noticed by DC system. They may be sent as soon as negotiation of the interface version is completed.

These modifications may be due to the following causes:

- Modification of the list of external talkgroups accessible at R6 interface

Transferred lists shall be exhaustive lists at every notification and shall supersede previous ones.

These notifications are delivered over R6-I3 interface using DCS_SORTED_LIST_IND message. The identification of the content of the sorted list is possible according to a sort criterion. It identifies the AG-trunk for which the list is delivered and the class of objects (OG). An acknowledgement is required from DAC side (message DAC_SORTED_LIST_ACK).

Possible causes of error are:

- bad parameters value
- request not supported
- unknown sort identifier

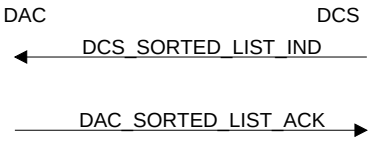

Figure 20: Spontaneous sorted list transfer from DCS

5.8 Call control

Basic services shall be offered on R6 interface for both private and group communications. Signalling concerning call control flow shall flow over R6-I3 interface.

Supplementary services may be offered optionally on R6 interface.

Once communication between the participants is setup:
- Voice traffic shall flow over R6-I1 interface.
- Voice traffic signalling shall flow over R6-I1 interface and may flow over R6-I3 interface.
- Call advertising shall flow over R6-I3 interface.

5.8.1 Common procedures for call control

5.8.1.1 Management of AG states for call control

The prerequisites for use of the AGs for call control procedures are described in local control and circuit control clauses. Local control defines which types of communications may be requested by the AG of an AG-trunk. Circuit control defines the behaviour of the AG itself.

As soon as these prequisites are reached, AG are usable for call control flow and their states shall be managed by the DCS.

From the AG resource itself, there are three states managed:
- **AG is free**. It may be used for call control procedures when a free AG is requested. It may be used either by TETRAPOL or by DC.
- **AG is busy**. It may be used for call control procedures involving current communication (supplementary services or withdrawal for example).
- **AG is reserved for monitoring**. No call control procedure shall use an AG declared as reserved for monitoring, neither from DC side nor from TETRAPOL side.

At first initialization of the interface, all AG shall be considered as free. Afterwards, AG for which group communication has been installed remain busy. In order to be sure they are free, a withdrawal from default call may be requested.

There is no possibility at R6 interface to request for these states of the AG.

Some AG may be reserved by TETRAPOL for incoming calls. DCS shall update the state of an AG when an incoming call is notified to DCS.

5.8.1.2 Preemption of AG

5.8.1.2.1 Selection and preemption of AG from TETRAPOL side

TETRAPOL system shall use an AG to notify incoming calls. Related to AG types described in 4.3.2.1 and addressing modes used by TETRAPOL subscriber, behaviour of TETRAPOL for incoming private calls is different.

5.8.1.2.1.1 Preemption with AG(trunk)

The only one available addressing mode is implicit addressing. No explicit addressing can be used by TETRAPOL subscribers to call DC.

In the case of implicit addressing, a free AG of the R6 interface must be used for the incoming call.

If no free AG is available, TETRAPOL system may preempt an AG involved in a private communication if the priority of the new communication is higher than priority of the current one.

The selection of an AG for an incoming call from TETRAPOL to DC shall be as follows:

- Search of an AG registered and free, belonging to an AG-trunk which authorizes private communications.
- If no AG corresponding to these parameters is available, several parameters shall be considered :
  - on going communication on AG is a group communication. The AG shall not be selected.
  - on going communication on AG is a private communication with a priority higher or equal than the one of the incoming communication. The AG shall not be selected.
  - installed communication on AG is a private communication with a priority lower than the one of the incoming communication. The AG shall be preempted by TETRAPOL.
- if no AG can be selected by TETRAPOL system, an overload signalling shall be sent to the DC with the identity of the calling party and priority requested for the call.

When an AG is preempted, current private communication shall be normally released by TETRAPOL, and the incoming call is then presented to the DCS.

5.8.1.2.1.2 Preemption with AG (terminal)

In this case, addressing modes that may be used by a TETRAPOL subscriber calling a DC for a private call are explicit adressing and implicit addressing. If implicit addressing is used, behaviour is the same as for previous clause.

If explicit addressing is used, the caller dials explicit address of the AG in TETRAPOL addressing plan. If the addressed AG is not free, following parameters shall be considered:

- Ongoing communication is a group communication and relative priority parameters to incoming communication allow preemption.
  Group communication will be preempted by TETRAPOL, with an end of ongoing communication followed by incoming setup message. In this case, it is DC role to manage group communication preemption. When the private communication will be released, AG will inform DC about characteristics of previously installed group communication, and will ask to DC if participation into group communication is still requested.
- Ongoing communication is a group communication and relative priority parameters to incoming communication do not allow preemption.
  AG is not preempted.
  Incoming call is rejected.
  No overload signalling is sent to DC.
- Ongoing communication is a private communication with a priority lower to incoming communication.
  AG is preempted with a normal release of current communication followed by presentation of incoming communication.
- Ongoing communication is a private communication with a priority higher or equal to incoming communication.
  AG is not preempted.
  Incoming call is rejected.
  No overload signalling is sent to DC.

5.8.1.2.2 Preemption of AG from DC side

If DC needs to preempt an AG, this shall be done by releasing the ongoing communication and install a new one.

There shall be no difference from DC side between release of communication for preemption and a normal release.

5.8.1.3 Collision of AG selections

Collision and call contention may occur when the DCS is notified of an incoming private call while sending a request to the same AG.

All call contentions over R6 interface shall be resolved by the DCS, so that AG and DAC are not involved in the AG transaction management.

In order to manage request collisions, DCS shall use AG identifier and call reference informations, present in all messages. In case of collision, DCS may receive a DAC_END message with an error cause meaning "AG busy" and a non significant call reference..

A private call setup from the TETRAPOL SwMI to the DC shall take precedence over the simultaneous transaction requested from DC side. If it doesn't, the incoming communication coming from TETRAPOL will be lost.

5.8.1.4 Management of call control flow

The call control flow consists in transactions with several messages to exchange.

No timers related to call control flow transaction is implemented in the DAC as TETRAPOL SwMI ones are assumed to apply.

Some common principles can be given for this management.

5.8.1.4.1 Call reference management

A call reference is attributed by the AG to every transaction. This call reference is a sequential number managed circularly by each AG. It is attributed by the AG at the beginning of the transaction and is valid for all its duration.

After this call reference has been attributed by the AG, it shall be provided for every message of the transaction coming from DC side or from TETRAPOL side.

As a general rule, all messages of call control flow needing a free AG have no call reference. All messages of call control flow involving a busy AG have a call reference which must be provided in the message. If not provided or erroneous, request shall be ignored by the receiver. If a request needing a free AG is sent on a busy AG, an error shall be sent back to the DCS with an AG busy cause.

The reception by the DC of a message with a significant call reference shall mean that the request is proceeding.

In case of an going transaction, if a call_reference inconsistency occurs over R6-I3 interface, the AG shall provide DAC_CALL_REFERENCE with the current reference and reference_type field set to CURRENT_REF in order to indicate which reference is valid. In this case, received request from DCS is not taken into account.

5.8.1.4.2 Transaction management

A transaction may be initiated by TETRAPOL or by the DC. Only one transaction of call control flow at a time may be requested to an AG. A transaction involves one and only one AG.

In every message of a transaction in call control flow, the involved AG identifier shall be provided.

If the transaction is initiated by TETRAPOL, the call reference is provided in the first message of the transaction.

If the transaction is initiated by DC, the call reference is provided in a specific reply by the message DAC_CALL_REFERENCE.

5.8.1.4.2.1 Cases of success

When a transaction succeeds, it may end with:

- A DAC_END message with no cause of failure (call over). This means that AG shall be considered in a free state at the end of the transaction over R6 interface.
- A DAC_CONNECT message. This signals that a voice path has been established between TETRAPOL and DC subscribers. The AG shall be considered in a busy state at the end of the transaction over R6 interface. This busy state shall be considered permanent even if there is no

activation of the communication. The normal way to retrieve an AG from busy state is to do a withdrawal from the communication.

Before the reception of the DAC_CONNECT message, the DC shall reserve the same AG resource over R6-I1 interface in order that voice traffic and voice traffic signalling could flow between the DC subscribers and TETRAPOL subscribers.

DAC_CONNECT message provides informations about the state of encryption and the call priority used for the communication.

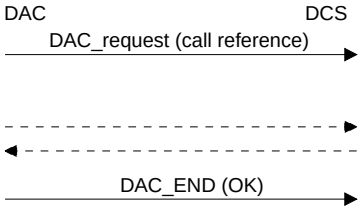

Figure 21: generic request from DAC succeeded (AG is free)

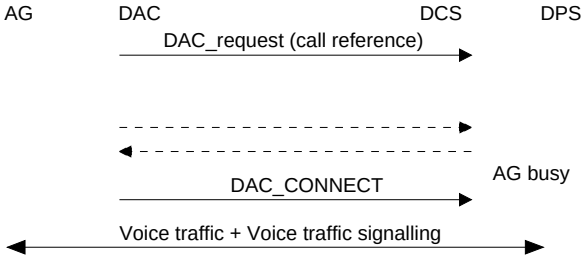

Figure 22: generic request from DAC succeeded (AG is busy)

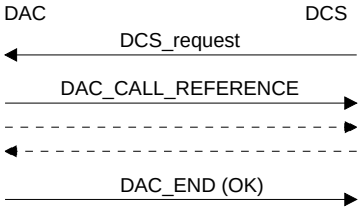

Figure 23: generic request from DCS succeeded (AG is free)

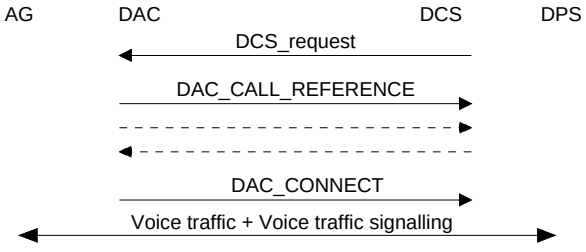

Figure 24: generic request from DCS succeeded (AG is busy)

5.8.1.4.2.2 Cases of failure

A transaction requested from DC may fail. Causes of failure may come from DAC, from the AG or from TETRAPOL SwMI. If a failure occurs, a DAC_END message is sent to DCS with the cause of failure. The AG identifier and call reference are provided in the DAC_END message to be sure of the involved communication.

Causes of failure coming from the DAC for call control flow may be :

- Request not supported. Means that this version of the protocol or of the product is not able to fulfill the request
- AG defectuous. Means that from DAC point of view, AG resource is unreachable and cannot be used for a request.
- Protocol error. An unexpected message has been received.
- Bad parameter value. Means that syntax of the request is erroneous.
- Invalid configuration. Error in DAC configuration that forbid access to a service.
- Call not supported by the AG-trunk. Means that type of call has been forbidden by configuration of the AG trunk
- Access right error. Means that OGs handled by AG trunk does not match with those of the communication for which a request has been sent.

Causes of failure coming from the AG for call control flow may be:

- AG busy. Means that a transaction needing a free AG has been asked on a busy AG. This may be a cause of collision of requests from DC and TETRAPOL side, or an inconsistent state handled by DCS.
- Bad parameter value. Means that syntax of the request is erroneous.
- Forbidden service.

Causes of failure coming from the SwMI for call control flow may be the same as those usually encountered for same services offered inside TETRAPOL system. At R6-I3 interface, all these causes are regrouped into family of causes.

Three groups of families may be encountered:

- error in the request from DCS. In this case, a new request with correct parameters may be asked.
  - Unknown number
  - Bad parameter
  - Open channel already setup
  - Maximum OG exceeded
- TETRAPOL system unavailable. A temporary problem exist in TETRAPOL system. The request is correct but cannot be fulfilled at this moment or resources have been preempted. If tried later on , this request may succeed.
  - Network overload
  - Distant preempted
  - No answer
  - Not registered
  - Refused service
  - Called terminal busy
  - Roaming station
  - Priority message
  - Priority incoming
  - Priority application
  - Notified call
  - Exceptional problem
  - Temporary problem
- TETRAPOL system failure. A persistent problem exist in TETRAPOL system which does not allow the service to be fulfilled
  - Network failure
  - Remote link failure
  - Link failure
  - Lost station
  - Forbidden service

Hereafter are described generic sequences of failure for call control flow :

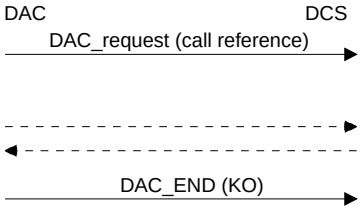

Figure 25: generic request from DAC failed

In this case, DAC_END message may arrive any when after the first message. The rest of the transaction is of course abandoned.

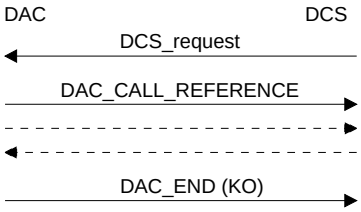

Figure 26: generic request from DCS failed

In this case, DAC_END message may arrive any when, even before DAC_CALL_REFERENCE. If DAC_END message arrives before DAC_CALL_REFERENCE message, this means that the failure has been detected by the DAC or the AG. The rest of the transaction is of course abandoned.

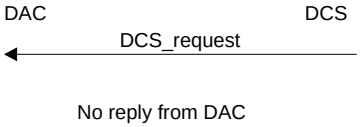

Figure 27: generic inconsistent request from DCS failed (no reply from TETRAPOL)

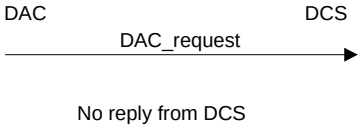

Figure 28: generic inconsistent request from DAC failed (no reply from DC)

As an exception, in case of DAC or DCS requests not following the protocol, they may be no response at all from DCS or DAC side. It is the role of the sender of the request to manage these cases in order that an AG does not remain unused for a long time.

This case may arrive after the initial request or any when after several exchanges of messages during the transaction.

5.8.2 Procedures for private communications

5.8.2.1 Scope

The private communications procedures apply to the following services:

- Individual call
- Multiparty call

Individual call service is mandatory at R6 interface. Multiparty call is an optional service. All supplementary services for private communications are optional.

The basic services for private communications are:
- Setup of a private communication from DC to TETRAPOL
- Setup of a private communication from TETRAPOL to DC
- Setup of a private communication from a PABX to DC through TETRAPOL
- Withdrawal of a participant from a private communication
- Release of a private communication initiated by TETRAPOL
- Release of a private communication initiated by DC

Supplementary services for private communications are:
- Silent call
- Remote clearing of a private communication from DC
- Ambience listening
- Call me back service
- Transfer of a private communication
- Intrusion into an on going private communication

5.8.2.2 Conditions for use of private communications

Call control procedures for private communications may flow as soon as negotiation of interface version has been completed. As there is no access control for private communication, there is no need that system monitoring flow has been completed.

5.8.2.3 Setup of a private communication from DC to TETRAPOL

A free AG belonging to an AG trunk authorizing private communications is needed for this transaction.

The general rules of management of transaction described in “Common procedures for call control” are valid for this function.

A private communication setup is initiated by DCS using DCS_OUTGOING_SETUP message.

Parameters for this message are:
- called party address, one for individual call or several for multiparty call (up to four).
- Called party subaddress for individual call to a PABX or to another DC.In this case, the subaddress is transmitted transparently through TETRAPOL system and should be interpreted in receiving external system.
- priority of the call. It is not possible to modify the priority of the call after the setup has been completed. In order to setup an emergency individual call, emergency priority shall be invoked. Other authorized priorities for individual calls are routine and flash. For multiparty calls, emergency priority shall not be invoked.
- possibility to invoke the supplementary service of silent call for individual calls only.

When the first called party is rung, TETRAPOL shall inform the DCS with DAC_ALERTING.

When the call connection between the SwMI and the AG is completed, DAC_CONNECT shall be received by the DCS. DAC_CONNECT message provides the encryption state of the communication.

Sequence for tone generating is optional (message DCS-TONE). If not requested, messages in brackets may be ignored. If requested, this message will generate tones on R6-I1 interface.

The scenario when the private call is successfully set-up from the DCS to the SwMI proceeds as follows with a free AG selected by the DCS:

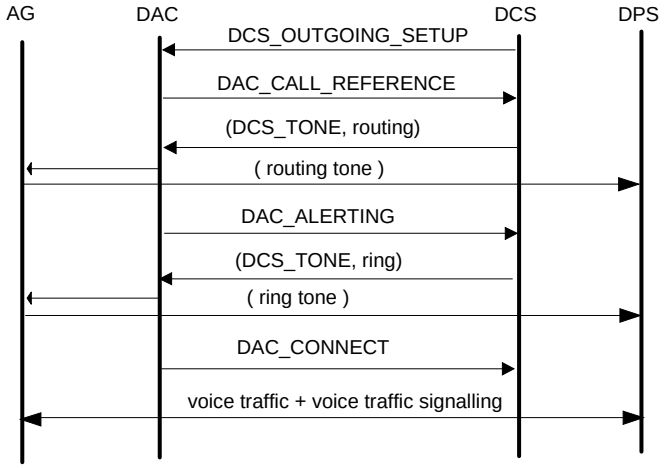

Figure 29: Private call successful set-up from DC to SwMI

Causes for failure.

5.8.2.4 Setup of a private communication from TETRAPOL to DC

Rules for selection and preemption of AG for private communications are described in “Preemption of AG”. The chosen AG must authorize private communications for this transaction.

The general rules of management of transaction described in “Common procedures for call control” are valid for this function.

A private communication setup is initiated by TETRAPOL using DAC_INCOMING_SETUP message.

Parameters for this message are:

- calling party address in TETRAPOL addressing plan.
- display of calling party address. If "No" value is set, this means that it has been requested that the identification of the subscriber is not displayed inside TETRAPOL system.
- called party subaddress, not interpreted by TETRAPOL system, which may be valid into DC addressing plan.
- priority of the call. It is not possible to modify the priority of the call after the setup has been completed. The priority of the call is set by the calling party. It may take routine, flash or emergency value.

Upon initiation of a private call setup request in the SwMI, involving the DC as a called party, TETRAPOL SwMI shall select an AG allowing private calls and route the setup request through it.

Upon reception of an incoming setup request, the DCS may alert one or several DC subscribers that may accept the call. When one of the DC subscribers has accepted the call, it shall be notified to DAC with DCS_CALL_ANSWER, before a delay managed inside TETRAPOL system.

There are two modes for refusing an incoming call :

- either send no answer to the incoming call, but the AG will stay in busy state till the delay is not elapsed
- or send a withdrawal from the call while setup is proceeding. In that case, incoming call will be released immediately and AG will stay in a free state.

After the delay elapsed with no answer from DCS side, the call will be abandoned and the AG will be in a free state.

On reception of DAC_CONNECT by the DCS, the incoming call setup is complete.

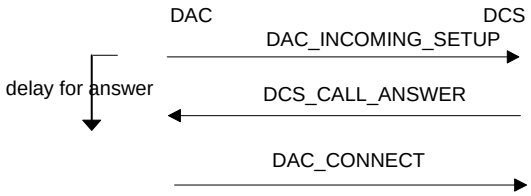

Figure 30: Private call from SwMI to DC

Causes for failure are those described in clause 5.8.1.4.2.

The call may prematurely ends if TETRAPOL calling party withdraws from the call while setup is proceeding. In that case, the call will end with a normal cause of end (call over).

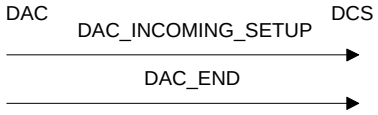

Figure 31: premature withdrawal from a private call by TETRAPOL subscriber

The call may prematurely ends if DC subscriber withdraws from the call while setup is proceeding. In that case, the call will end with a normal cause of end (call over).

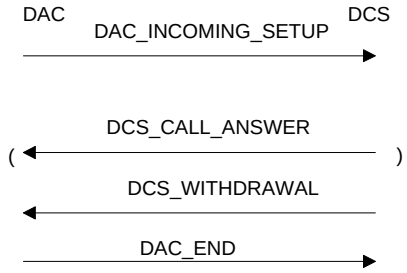

Figure 32: premature withdrawal from a private call by DC subscriber or DCS

In some cases (refer to clause 5.8.1.2 for description), when a private call cannot reach the DC, an overload signalling is sent to DC in order to inform about identity of the caller and priority of the call.

Figure 33: Signalling of a failure of private call setup to a DC

5.8.2.5 Setup of a private communication from a PABX to DC through TETRAPOL

As there are PABX gateways in TETRAPOL system that allows calls coming from a PABX, it is possible that these calls are adressed to a DC through an AG of R6 interface.

The procedures for setup of these communications are the same as those described in “Set up a privatecommunication fromTETRAPOL to DC”.

Only noticeable differences are:

- That DAC_INCOMING_SETUP message signals that call comes from a PABX and not from a usual TETRAPOL subscriber.
- That priority of the call can only be routine priority.

5.8.2.6 Withdrawal of a DC subscriber from a private communication

The DC may withdraw from a call to which it participates through the AG involved in the call. From TETRAPOL point of view, there is only one AG involved in the call, even if several DC subscribers are involved in the call. It is DC role to manage withdrawal of one of the DC subscribers.

This request can be done even during call setup proceeding. If though, setup of private call is aborted prematurely.

Initiated by the DCS, a withdrawal of the DC is requested with DCS_WITHDRAWAL. This message shall be sent when no DC subscribers left want to participate into the private call.

The call reference and AG identifier of the originating call shall be provided.

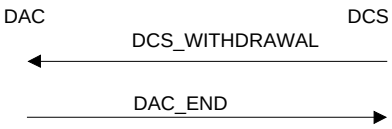

Figure 34: DC withdrawal from a private call

Except if message is bad formatted, the withdrawal request shall always succeed from the DC point of view, so that the related AG turns to "free" state.

5.8.2.7 Private communication release initiated by TETRAPOL SwMI

Release of a private communication is similar for individual and multiparty call. For a multiparty call, DCS is not informed of the withdrawal of one of the TETRAPOL subscriber acting as a called party. A release of a private communication is definitive.

The procedure for a SwMI to release a private call involving a DC is described as follows:

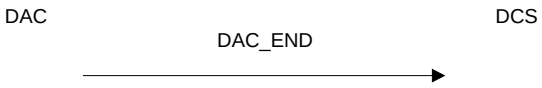

Figure 35: Private call release indication

The family cause in DAC_END message may be a normal cause of end (call over), or may indicate a cause of failure coming from SwMI as described in “transaction management”.

5.8.2.8 Private communication release initiated by DC

This case is described as the withdrawal from the AG participating into the private communication. From DC point of view, this request will always succeed (if request is correctly formatted).

If the private call is an individual call, then the withdrawal of one participant implies the release of the call.

If the private call is a multiparty call initiated by DC, then the withdrawal from the AG implies the release of the call. If not initiated by DC, release of the communication is controlled by TETRAPOL SwMI.

5.8.2.9 Remote call clearing

A free AG belonging to an AG trunk authorizing private communications is needed for this transaction.

The general rules of management of transaction are valid for this function.

This transaction may be requested by the DCS to release a private communication (either individual or multiparty call) in which the DC does not participate. Message DCS_REMOTE_CALL_CLEARING needs the address of the calling party in TETRAPOL addressing plan as parameter.

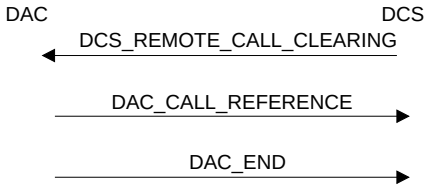

Figure 36: Remote call clearing

5.8.2.10 Ambience listening

Ambience listening is possible on an individual call (not a multiparty call) in which the DC participates. This means that an AG is busy with this communication at R6 interface.

This may be requested from DCS when setup of the individual call is completed successfully. Parameters for message DCS_REMOTE_PTT_REQ are:

- Address in TETRAPOL addressing plan of the ST expected to transmit.
- Duration of the transmission

No acknowledgement of this message is requested from TETRAPOL side. If this request is incoherent or invalid, it shall be abandoned by TETRAPOL with no indication to DC.

If the request succeeds, the target ST shall transmit on voice circuit during the requested transmission duration.

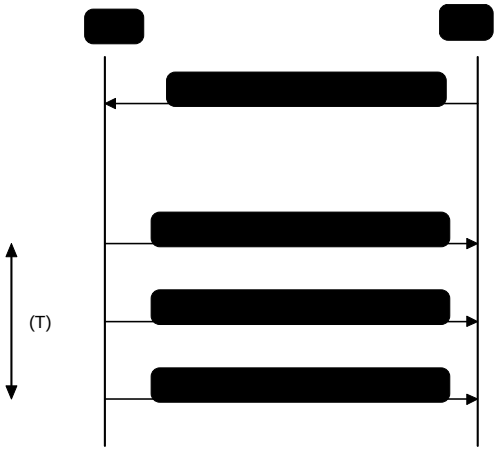

Figure 37: Request for ambience listening

5.8.2.11 Call back service

This service allows a TETRAPOL subscriber to be called back by a dispatcher.

The dispatcher is informed of the TETRAPOL subscriber request by the reception of a predefined status with a particular status code.

Following the reception of the status, the dispatcher may (or not) setup an individual call with the TETRAPOL subscriber.

Figure 38: Signalling for call back of a TETRAPOL subscriber

5.8.2.12 Transfer of a private communication

Transfer is possible on an individual communication (not a multiparty call) already setup in which the DC participates as a called party.

It is possible for the DC to transfer the call to another TETRAPOL subscriber referenced in the TETRAPOL addressing plan, or to a PABX gateway.

This means that an AG is busy with this communication at R6 interface.

The general rules of management of transaction are valid for this function.

This may be requested from DCS when setup of the individual call is completed successfully.

Parameters for message DCS_TRANSFER are:

- AG identifier and call reference of the individual communication to transfer
- Address of the TETRAPOL subscriber or PABX gateway in TETRAPOL addressing plan to which the transfer is made and optionally subaddress to be interpreted by a PABX if the address is the one of a PABX gateway.

At the end of the transaction, the AG is in a free state and is not involved any more in the individual communication.

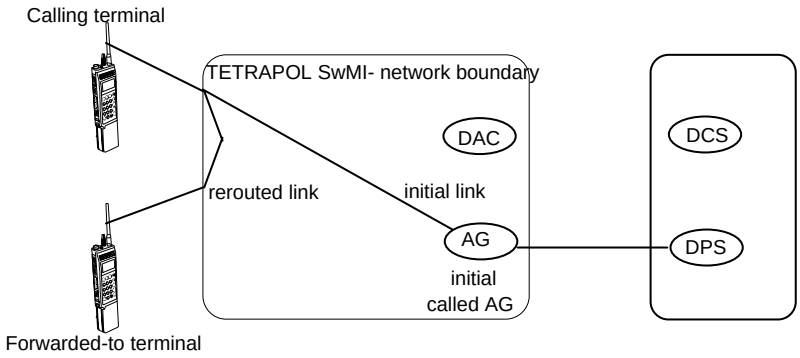

Figure 39: Call transfer: rerouting of speech path

The called DC shall request a transfer to a TETRAPOL subscriber as follows:

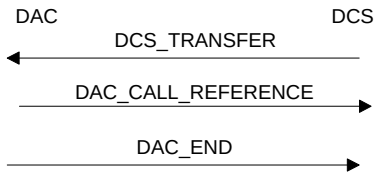

Figure 40: Call transfer request sequence

Causes for failure are those described in “Common procedures for call control”.

5.8.2.13 DC intrusion into an on-going private communication

A free AG belonging to an AG trunk authorizing private communications is needed for this transaction.

The general rules of management of transaction described in “Common procedures for call control” are valid for this function.

This transaction allows the DC to enter an already setup private communication between TETRAPOL subscribers (either individual or multiparty communication) in which it does not participate. The DC

requesting intrusion should belong to the same organization as calling and /or called parties involved in the communication.

DCS requests intrusion in a private communication using DCS_INTRUSION message. The request from the DCS shall contain identification of the calling party in which the DC wishes to participate.

On receipt of the intrusion request, the SwMI shall allocate a call reference over R6 interface and shall indicate to the DCS that the call is proceeding with a DAC_CALL_REFERENCE.

Upon call connection between the SwMI and the AG, DAC_CONNECT shall be received by the DCS and the setup is complete.

The scenario when the intrusion is successfully set-up from the DCS to the SwMI proceeds as follows:

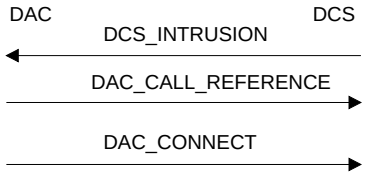

Figure 41: Private call intrusion sequence

The procedure for the withdrawal of the intruding AG and the procedure for call release initiated by the SwMI shall be similar to those for a private call.

As for setup of private communications, The DC may withdraw prematurely from an intruded call during setup of the intrusion. Upon receipt of DAC_END, the call reference shall be deallocated.

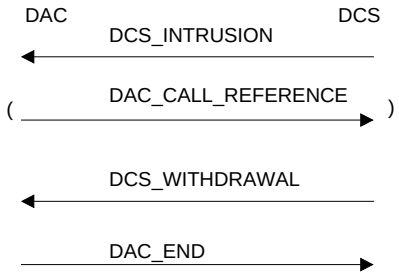

Figure 42: Premature withdrawal form private call intrusion

The intruder may withdraw from the call with the withdrawal procedure for private call as defined above.

When the call is released, the SwMI and the DAC proceed with the release procedure that apply to AG and DCS.

5.8.2.14 Interaction of private communications with TETRAPOL fallback modes

There is no specificity to R6 interface for TETRAPOL fallback modes. The rules of management available inside TETRAPOL system for private communications are the same for R6 interface.

If a setup request from DC cannot succeed, an error will be sent by the TETRAPOL SwMI if it is in fallback mode.

In FBM1 and FBM2, private calls not impacted will go on, and private calls impacted will be released from DAC side. Requests of setup if distant is not available will fail.

In FBM31 and FBM32, setup of private communications are not allowed, and on going private calls are released by the TETRAPOL SwMI.

5.8.3 Procedures for Multisite Open Channel communications

5.8.3.1 Scope

The procedures described in this clause apply to the following services:

- MOCH
- Broadcast open Channel
- Emergency Multisite Open Channel
- Emergency Single site Open CHannel
- Scanning communication
- Talkgroup merging communications, all based on multi site open channel principles

Specificties related to emergency communications, group-merging communications, and scanning services are described in specific clauses.

The basic services for these group communication in call control flow are:

- Setup of a communication
- Release of a communication
- Participation into a communication
- Withdrawal of a communication

All these services are mandatory at R6 interface.

5.8.3.2 Setup of a Multisite open channel from DC

5.8.3.2.1 Prerequisite

The prerequisites for a DC to request the set-up for a multisite open channel are as follows:

- There shall be a trunk that fulfils coverage and partitioning requirements.
  Coverage requirements means that AG trunk must be linked to an AH which is included in the coverage of the MOCH.
  Partitioning requirements means that AG trunk must own at least one of the OG attached to the MOCH.
- There shall be a free access gate in that trunk.

5.8.3.2.2 Procedure for set-up

A free AG is needed for this transaction.

The general rules of management of transaction described in “Common procedures for call control” are valid for this function.

The DCS requests for a MOCH setup using the DCS_MOCH_SETUP message.

Parameters for this message are:

- identification of the AG to be used
- identification of the MOCH
- call priority which is related to the type of the communication
  Routine priority allows setup of MOCH or talkgroup merging communications
  Broadcast priority is mandatory to setup a broadcast call.
  Crisis priority is mandatory to setup a EMOCH
- Optional list of participation OG that override the default ones defined in TETRAPOL system. The list of OG provided for the MOCH applies only for setup and is not related to the OG owned by the trunk of AG.In case of ciphering, the participation OG should have coherent ciphering capabilities with those of the MOCH. If not, groups using these OGs could not traffic in the group communication.

Encryption mode (cyphered or clear) may not be determined through this interface. This will be defined by the TETRAPOL SwMI.

It may be noted that the DC cannot participate in the multisite open channel by just setting it up.

When the MOCH has been succesfully setup, it appears in the lists of system monitoring flow if an AH of the R6 interface is included into the coverage.

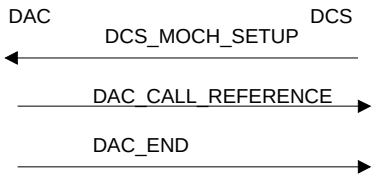

Figure 43: Multisite open channel set-up

Causes for failure are those described in clause 5.8.1.

5.8.3.3 Multisite open channel release from DC

5.8.3.3.1 Prerequisite

The prerequisites for a DC to request the release for a multisite open channel are as follows:

- The MOCH shall be completely established
- There shall be a trunk that fulfils coverage and partitioning requirements.
  Coverage requirements means that AG trunk must be linked to an AH which is included in the coverage of the MOCH.
  Partitioning requirements means that AG trunk must own at least one of the OG attached to the MOCH.
- There shall be a free access gate in that trunk.

There is no control from TETRAPOL that no AG of the R6 interface participate into the MOCH.

5.8.3.3.2 Procedure for release

A free AG is needed for this transaction.

The general rules of management of transaction described in “Common procedures for call control” are valid for this function.

The DCS requests for a MOCH release using the DCS_MOCH_RELEASE message.

Parameters for this message are:
- identification of the AG to be used
- identification of the MOCH

When the MOCH has been succesfully released, it disappears from the lists of system monitoring flow.

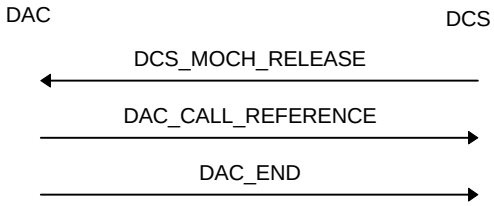

Figure 44: Multisite open channel release

Causes for failure are those described in “Common procedures for call control”.

5.8.3.3.3 Procedure for release a BOCH

Definition of the BOCH service requests that this communication is released at the end of the first activation.

In case of a BOCH setup by a DC, it is also DC role to release the BOCH at the end of the first activation.

This communication will not be automatically released by TETRAPOL. As called parties cannot talk into BOCH communication, useless resources will be reserved by the network if not released from DC.

Procedure for release a BOCH is the same as for a MOCH.

5.8.3.4 Participation in a multisite open channel

5.8.3.4.1 Prerequisite

The prerequisites for a DC to request the participation into a multisite open channel are as follows:

- The MOCH shall be completely established (it shall appear in system monitoring lists)
- There shall be a trunk that fulfils coverage and partitioning requirements.
  Coverage requirements means that AG trunk must be linked to an AH which is included in the coverage of the MOCH.
  Partitioning requirements means that AG trunk must own at least one of the OG attached to the MOCH. It also means that AG trunk must authorize this type of communications.
- There shall be a free access gate in that trunk.

5.8.3.4.2 Procedures for participation

A free AG is needed for this transaction.

General rules of management described in “Common procedures for call control” are valid for this function, except that DAC_CALL_REFERENCE message is not sent as a reply to DCS request, because call reference is included in DAC_DEFAULT_CALL_IND message.

DC participation applies to all subsequent activations on that group communication until the DC withdraws the AG from it, or the communication is released.

The DCS requests for participation in a MOCH using the DCS_DEFAULT_CALL_ENTER message.

Parameters for this message are:
- identification of the AG to be used
- identification of the MOCH
- type of the communication (either MOCH, EMOCH, broadcast) consistent with the type provided for setup

The priority of the call may not be changed while requesting for participation.

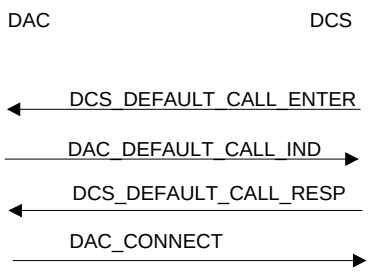

Figure 45: Participation in a multisite open channel

DCS_DEFAULT_CALL_ENTER message requests for participation. It includes identification of the MOCH. No modification of the parameters of the MOCH is available while requesting for participation. No

specific access rights may be updated while requesting for participation. Access control rights for partitioning are done by the DAC on reception of this message.

DAC_END reply to this message may occur for any cause of failure described in “Common procedures for call control”.

DAC_DEFAULT_CALL_IND message indicates that AG entry for participation in a MOCH. The call reference is provided in this message.

DCS_DEFAULT_CALL_RESP message shall be sent by DCS to acknowledge the entry for participation into the MOCH.

DAC_END reply to this message may occur if a bad parameter value is encountered (error of call reference or AG number) or if AG is defectuous.

DAC_CONNECT message indicates that voice traffic and voice traffic signalling may flow over R6 interface. This message also indicates encryption state of the communication.

AG will remain busy if this transaction has ended successfully and cannot be used for another purpose.

As long as no other participation procedure involving this AG is requested, it will remain installed.

If an AG is preempted from SwMI side for participation to a private communication or for OG or key deliveries, DC is informed by a normal end of group communication (DAC_END message). The default group communication shall be kept by TETRAPOL side.

In this case, When previous action has ended, AG requests for a confirmation that previously installed communication shall always be. This is done from SwMI side using DAC_DEFAULT_CALL_IND message with the same parameters as those provided in DCS_DEFAULT_CALL_ENTER message.

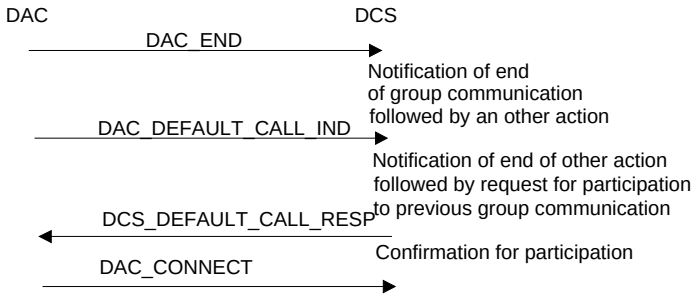

Figure 46: Confirmation of participation in a preempted group communication

5.8.3.5 Withdrawal from a multisite open channel

Prerequisite for the DCS to request from a withdrawal is that an AG participates into the communication. Withdrawal from a MOCH may be requested from DCS even if AG trunk has got no access rights to the MOCH.

Procedure for participation in a MOCH must have been previously successfully completed on that AG.

When a MOCH is released for TETRAPOL side, it disappears from the lists broadcast in system monitoring flow. In this case, the DCS may withdraw the AG from the MOCH in order to use it for another purpose.

Withdrawal from a MOCH may be requested upon DC internal needs or because an event occurs from R6 interface:

- release of the MOCH which means disappearing from system monitoring lists of the AG trunk
- lose of access rights in the AG trunk which means also disappearing from system monitoring lists

DCS requests for withdrawal from a MOCH using DCS_DEFAULT_CALL_WITHDRAWAL. Parameters of this message are:

- AG identifier: this shall concern AG busy for participation in the MOCH.
- Call reference used for participation into the MOCH

The AG shall not leave temporarily the group communication for another application.

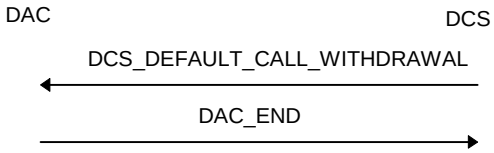

Figure 47: DC withdrawal request from DCS

5.8.4 Procedures for emergency communications

5.8.4.1 Scope

Specific procedures exist for emergency communications, depending on configuration of emergency stiuations managed in the system.

It is out of the scope of this document to describe all configurations possible for emergency communications in TETRAPOL.

This configuration mode applies to private emergency communication, ESOCH and EMOCH communications. Procedures at R6 interface for private emergency communications are described in “Procedures for private communications”.

5.8.4.2 Emergency group communications set-up

5.8.4.2.1 Setup in emergency situations

Configuration of the emergency communications in the system is possible for each organization of TETRAPOL subscribers. It allows following possibilities:

- Choice of the type of communication to setup (EMOCH or ESOCH or nothing)
- setup of emergency communication automatically by TETRAPOL system, or following a request /reply from a DC subscriber

When a TETRAPOL subscriber signals an emergency situation, a signalling message DAC_SIGNALLING_IND is sent to DCS. This message provides identification of the TETRAPOL subscriber in TETRAPOL addressing plan and its location (radio cell where the subscriber is registered). It may be send to several R6 interfaces at the same time.

This message shall also indicate the type of emergency communication to be established, and whether a reply is requested from a DC subscriber. If a reply is needed, the DCS may accept or refuse the setup of the emergency group communication using DCS_EMERGENCY_SETUP_ACK. The setup of the emergency communication shall be done automatically by TETRAPOL on positive acknowledge of this message. Following this sequence, there is no specific need to setup emergency communication explicitly.

If several replies from several R6 interfaces are received by TETRAPOL, only the first one will be taken into account. Others are ignored.

If no reply is received by TETRAPOL after a delay, emergency group communication will be setup automatically.

Upon establishment of an ESOCH by TETRAPOL which includes the R6 interface in its coverage, the DAC shall inform the DCS with a DAC_EMERGENCY_NOTIFICATION message. This message provides identification of the ESOCH and means that setup of the ESOCH has completed succesfully.

Upon establishment of an EMOCH by TETRAPOL which includes the R6 interface in its coverage, the DAC shall inform the DCS with a DAC_CRISIS_NOTIFICATION message. This message provides identification of the EMOCH and means that setup of the EMOCH has completed succesfully.

When an ESOCH or an EMOCH is setup, it appears in the system monitoring lists.

Procedure for an emergency communication with automatic setup by TETRAPOL may be as follows:

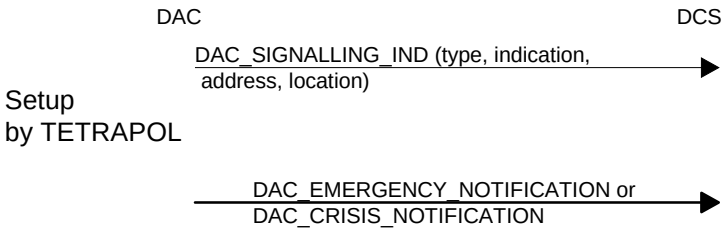

Figure 48: automatic setup of emergency group communication by TETRAPOL

In DAC_SIGNALLING_IND message:
- type indicates whether an EMOCH or an ESOCH is to be setup
- indication indicates whether setup is automatic or needs a reply from DC (automatic in this case)
- address is this of the TETRAPOL subscriber in emergency situation
- location is its registration radio cell

Procedure for an emergency communication with non automatic setup by TETRAPOL may be as follows:

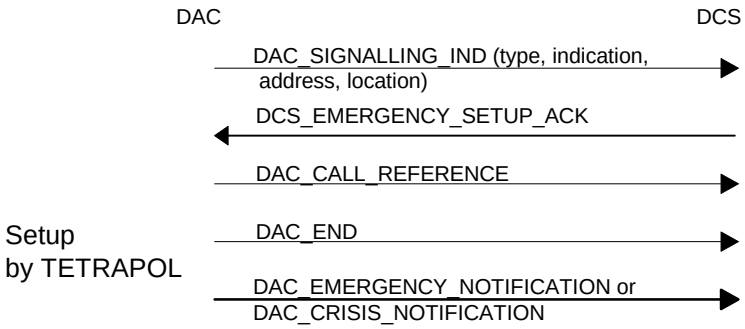

Figure 49: setup of emergency group communication authorized by dispatcher

In DAC_SIGNALLING_IND message:
- type indicates whether an EMOCH or an ESOCH is to be setup
- indication indicates whether setup is automatic or needs a reply from DC (needs a reply in this case)
- address is this of the TETRAPOL subscriber in emergency situation
- location is its registration radio cell

DCS_EMERGENCY_SETUP_ACK needs a free AG to be sent on R6 interface. It has to be the first one received by TETRAPOL and has to be sent within a delay to be taken into account. Of course, if refused, setup will not be effective and DAC_XXX_NOTIFICATION will not be received by DCS.

Causes for failure are those described in “Call control”. If failure is detected by DAC or AG, DAC_END message with cause of failure is sent to DCS instead of DAC_CALL_REFERENCE message (rest of transaction is abandoned). If failure is detected by SwMI, DAC_END message will be sent with a cause of failure, and DAC_XXX_NOTIFICATION will not be received by DCS.

DAC_XXX_NOTIFICATION may be received several times by DCS with identification of different TETRAPOL subscribers in emergency situation. These messages are received by DCS even if no AG of the R6 interface is participating to the emergency communication.

5.8.4.2.2 Setup outside emergency situations

An emergency group communication may be set-up upon DC initiative. In this case, it does not follow reception of DAC_SIGNALLING_IND message.

For an EMOCH, procedure for setup is the same as for MOCH except that call priority has got a specific value ("crisis", refer to specific clause).

For an ESOCH, procedure for setup is the same as for MOCH except that DCS_MOCH_SETUP message is replaced by DCS_ECH_SETUP.

The DCS shall select a free AG from a trunk that fulfils coverage requirements. The DCS is informed whether its request has been successfully sent to the SwMI. This does not ensure that the SwMI will actually set the ECH up.

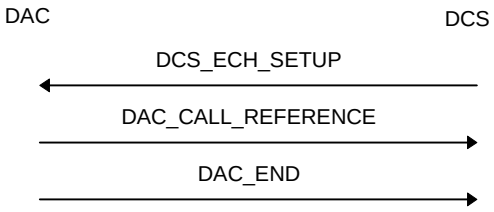

Figure 50: Emergency open channel set-up sequence

If an emergency open channel already exists in the cell, this sequence shall remain the same.

In case the DC is not allowed to set-up the emergency open channel through that trunk, DAC_END shall contain the appropriate cause indication.

5.8.4.3 Emergency group communication release

The release of an EMOCH is the same as for MOCH.

For an ESOCH, a specific transaction needing a free AG exist.

The general rules of management of transaction described in “Common procedures for call control” are valid for this function.

The prerequisites for a DCS to request the release of an ESOCH, to which it does not participate, are as follows:

- No access rights are defined for ESOCH communications.

DCS requests for a ESOCH release using the DCS_ECH_RELEASE message.

Parameters for this message are:

- AG identifier of a free AG
- identification of the ESOCH

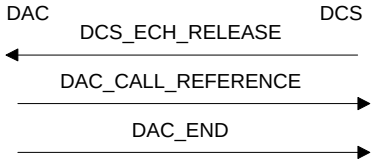

Figure 51: Emergency open channel release

5.8.4.4 Participation in an ESOCH or an EMOCH

Procedures for EMOCH are the same as for MOCH.

The prerequisites for a DC to request participation into an ESOCH are as follows:

- The ESOCH shall be established.
- There shall be an available AG from an ad hoc trunk that fulfils coverage requirements. This means that this must be a radio AG registered in the radio cell where the emergency situation occured, or a line connected AG registered in a line connected cell which is included in the coverage of the ESOCH.
- No partitioning requirements exist for ESOCH communications. All AG, belonging to any organization may participate to an ESOCH communication.

The procedures are similar to the MOCH procedures.

5.8.4.5 Withdrawal from an ESOCH or an EMOCH

The procedures are similar to the MOCH procedures.

5.8.5 Procedures for talkgroup

5.8.5.1 Scope

The setup and release of a talkgroup shall not be performed from the DC.

The basic services for these group communications in call control flow are:
- participation into a talkgroup
- withdrawal from a talkgroup

Same procedures apply both for internal OG and for external OG (used for talkgroup identifying) provided from the DC to the DAC as described in system monitoring clause.

Supplementary services for talkgroups allows group merging of talkgroups into one talkgroup merging communication.

These services are mandatory at R6 interface.

5.8.5.2 Participation in a talkgroup

5.8.5.2.1 Prerequisite

The prerequisites for a DC to request the participation into a talkgroup are as follows:

- The talkgroup identification shall appear in system monitoring lists for talkgroups identified by internal OGs
- For talkgroups identified by external OGs, they shall have been provided previously by DCS to the relevant AG trunk of the DAC to be used (System monitoring).
- There shall be a trunk that fulfils coverage and partitioning requirements.
  Coverage requirements means that AG trunk must be linked to an AH which is included in the coverage of the talkgroup.
  Partitioning requirements means that AG trunk must own the OG attached to the talkgroup. It also means that AG trunk must authorize this type of communications.
- There shall be a free access gate in that trunk.

5.8.5.2.2 Participation procedure

Procedure is similar to MOCH procedure.

Differences are in parameters of DCS_DEFAULT_CALL_ENTER message :
- identification of a talkgroup (composed of coverage identification, OG identifier). For external talkgroups, this full identification must be provided consistently with definition in TETRAPOL system.
- The call type shall be the one of a talkgroup

It is not possible to modify the characteristics of a talkgroup while requesting for participation.

Causes for failure are those described in “Common procedures for call control”.

5.8.5.3 Withdrawal from a talkgroup

Procedure is similar to MOCH procedure.

5.8.6 Group merging

5.8.6.1 Scope

The procedure temporarily merges several groups over a coverage area predefined. This supplementary service shall be invoked using MOCH basic services.

Group merging communications are setup by dispatchers.

When a talkgroup is merged into a group merging, the TETRAPOL terminals which were participating into initial talkgroup automatically participate to the group merging communication.

At R6 interface, if an AG was participating into a talkgroup which is merged, it is DC role to switch participation of the AG into the group merging communication instead of initial talkgroup (withdrawal from initial talkgroup followed by a participation into group merging communication). Otherwise, DC could activate talkgroup, but could not talk with TETRAPOL terminals belonging to the OG of the talkgroup.

Services associated to group merging are the same as for MOCH:
- setup of a group merging communication
- release of a group merging communication
- participation into a group merging communication
- withdrawal from a group merging communication

5.8.6.2 Setup of a group merging

Procedure for setup of a group merging communication are the same as for MOCH.

Differences are in parameters of DCS_MOCH_SETUP message:
- identification of the MOCH must be chosen so that its coverage matches the one of the groups to be merged.
- A list of OG shall be provided. These OGs are those which identifies the groups to be merged.

5.8.6.3 Release of a group merging

Procedure for release of a group merging communication is the same as for MOCH.

5.8.6.4 Participation in a group merging

Procedure for participation in a group merging communication is the same as for MOCH.

5.8.6.5 Withdrawal from a group merging

Procedure for withdrawal from a group merging communication is the same as for MOCH.

5.8.7 Scanning service

5.8.7.1 Scope

Scanning service is defined as the ability for a DC to listen sequentially to a set of predefined communications.

The scanning service shall be provided by the TETRAPOL system.

Scanning service uses the following features:

- Broadcast of the list of the active communications for each trunk.
- Participation request on a particular AG. The AG will remain busy until the withdrawal from the scanning service is done.
- Talking into a communication among those defined for the scanning.
- Listening to the communications.
- Update the list of communications for talkgroup merging
- Skip the listening to a communication.
- Withdrawal from the scanning service.

There are two different scanning modes:

- Priority scanning
- Sequential listening

Priority scanning shall only concern a set of MOCHs.

Sequential listening shall concern a subset of talkgroups mixed optionally with a subset of talkgroups merging communications. The talkgroups may be identified by an internal or an external OG. Sequential listening may also concern a subset of MOCHs.

MOCHs may not be associated with talkgroups in a scanning request, except for talkgroup merging.

5.8.7.2 Applicability

The prerequisites for a DC to request **the installation of scanning service** on a list of communications are as follows:

- The MOCH listed for the scanning shall not be Emergency Open Channels nor Broadcast calls. These may be normal or crisis MOCHs, or talkgroup merging.
- The talkgroups listed for the scanning may be identified by internal or external OGs.
- For a priority scanning, the priority communication shall be setup in the TETRAPOL SwMi.
- For a sequential listening, at least one of the communication shall be setup.
- The DCS shall be able to select a free access gate belonging to a trunk which handles at least one participation OG of every MOCH or the OG of the talkgroup. This means that the communication must be accessible to the trunk.
- The list of communications shall be ordered with the priority one being first. The priority communication is the communication on which manual keying and notification of activations shall apply.

During an **on going scanning service**, the list of communications included in a scanning service shall not be changed, except for talkgroup merging. If a talkgroup is merged in a talkgroup merging communication, DCS may optionally replace the originating talkgroup by the identification of the talkgroup merging communication.

Otherwise, should an update be required, a withdrawal shall be sent from the DCS, followed by a new participation with the new list of communications.

Should no communications be accessible at SwMi side, the scanning service remains installed until DCS requests for withdrawal.

5.8.7.3 Participation in a scanning communication

The procedure for participation in a scanning service is the same as for participation to a MOCH. Refer to “participation in a multisite open channel” the description of the protocol.

Difference is in the parameters of DCS_DEFAULT_CALL_ENTER message:

- A list of communication identifications shall be provided. For a priority scanning, this shall only be a list of MOCH. For a sequential listening, this may be a list of talkgroups and/or MOCH.

- Call type of the communication shall indicate which type of scanning is requested (priority scanning or sequential listening.

Possible causes for failure are the same as for participation to a MOCH.

5.8.7.4 Talking while scanning

Depends on scanning mode:

- PTT request on a priority scanning shall activate priority communication.
- For a sequential listening, if no communication is active, PTT request shall activate priority communication. If a communication is active, PTT request shall be associated to currently active communication.

Should the priority communication be unaccessible, the DC may not request any PTT into a priority scanning . For a sequential listening, PTT requests remains possible when non priority communications are activated.

5.8.7.5 Listening to communications

On activation of one of the communications, AG automatically listens to the communication.

If another communication is activated while the first one is still active, behaviour depends on scanning mode :

- For priority scanning. Activations of priority communication are always listened. So preeemption of non priority communication shall be processed in order that priority communication is listened. On the opposite, there is no preemption of the active communication if it is the priority one.
- For sequential listening. There is no priority between communications. The currently active communication shall not be preempted by another one.

Should one of the communications be unaccessible or released at SwMi side, then the communication is deleted from the list of the active communications of system monitoring flow. DCS may then optionally request to DAC a withdrawal from the scanning.

Should one of the communications be unaccessible or released at SwMi side, this communication cannot of course be listened any more by the DC. Other communications of the list may continue to be listened to.

5.8.7.6 Update the list of communications of a scanning

This request may be optionally provided by TETRAPOL. It may be used by the DCS in order to request the modification of the list of communication to be scanned. The number of communications in the list shall be the same as for participation phase.

This may be used for the following purposes:
- Change the priority communication. In this case, the list of communications is the same as the previous one, but they are ordered differently.
- Listen to a communication merged into a talkgroup merging communication. The list may be the same as the previous one, except that one or several communications identifiers may be replaced by the talkgroup merging communication identification. When the originating communication is no more merged into talkgroup merging communication, DCS may request the opposite in order to listen to initial talkgroup communication.

This request shall not be used to add nor to delete communications from the list.

DCS_MODIFY_DEFAULT_CALL may be requested from DCS to DAC to update the list of communications as described below.

There is no acknowledgement from TETRAPOL for this request.

5.8.7.7 Resume scanning while participating

In order to resume scanning to other communications, the DCS may send a DCS_SCAN_RESUME request to DAC. There is no acknowledgement from TETRAPOL for this request.

An other on going communication is searched in the scanning list in order to be listened to. The listening of the current communication shall be suspended for a definite time.

This request shall be forbidden by the DCS in scanning priority mode on the priority communication.

A PTT request on a suspended communication still activates it.

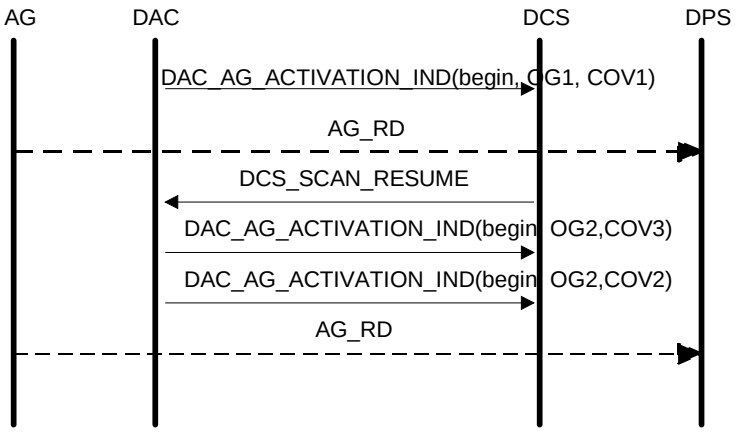

Figure 52: Example for resume scanning

In the figure the dotted exchange AG_RD shall indicate that at the involved access gate the receive detection (RD) signal is set on the R6-I1 interface. Note that this is not a message between DAC and DCS.

5.8.7.8 Withdrawal from scanning

Procedure is similar to MOCH procedure.

5.8.8 Interaction of group communications with TETRAPOL fallback modes

There is no specificity to R6 interface for TETRAPOL fallback modes. The rules of management available inside TETRAPOL system for group communications are the same for R6 interface.

In FBM1, group communications are not impacted.

In FBM2 and FBM31, group communications will go on, but can be used on a reduced coverage.

In FBM32, there is no group communications nor private communications available. FBM32 may only concern radio cells. The only one accessible communication is the fallback MOCH requested using DCS_FALLBACK_MOCH_ENTER. This is a predefined communication and no identification of the communication is requested at R6 interface. There are no access rights related to this communication.

As it is the only one communication available in this mode, only messages authorized are those related to this communication.

A free AG is needed to enter into this communication. This request is not available outside FBM32 mode.

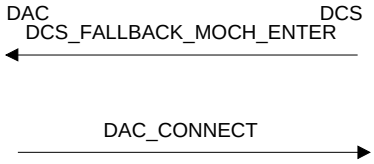

Figure 53: request for entry into fallback MOCH (FBM32)

If a failure is detected by TETRAPOL, a DAC_END message is sent to DCS.

It is possible for DCS to withdraw from this communication using DCS_WITHDRAWAL request. Sequence for a withdrawal from fallback MOCH is:

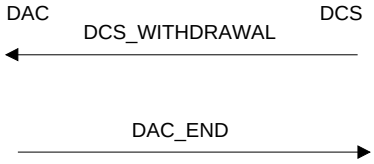

Figure 54: request for withdrawal from fallback MOCH (FBM32)

5.9 Data services

5.9.1 Scope

The only one data service available at R6 interface concerns short message services (SMS).

It allows to send short messages to TETRAPOL, and to receive short messages coming from TETRAPOL.

Two basic services exist for short message services at R6 interface:
- predefined status with a status code defining a particular meaning
- text messages status of a limited size.

The same protocol shall be used to exchange SMS for one or the other service.

These services are mandatory at R6 interface.

5.9.2 Status reception

The procedure for receiving a status is as follows:

Figure 55: SMS reception

This message may be either a predefined status or text message status.

Address of the sender of the SMS is provided. If the sender is an external server or a dispatcher, no address is provided.

Priority of the SMS is provided.

SMS application identification used for reception of the SMS is provided at interface.

5.9.3 Status transmission

Addressing capabilities for emission of SMS are:
- identification of the SMS application. Used to address the SMS to a particular application of the receiver
- an OG. All TETRAPOL subscribers who have this OG and registered under an associated coverage will receive the status. Other R6 interfaces will not receive the SMS (even if they have got the OG).
- An address in TETRAPOL addressing plan. This may be an implicit or an explicit address. If it is an implicit address, all TETRAPOL subscribers assigned to the implicit address that requested for the reception of SMS will receive the status. If no subscriber requested for the reception of SMS, the SMS will be sent to only one subscriber (free and available).
- A functional address. Corresponds to a list of TETRAPOL addresses and/or external addresses. All subscribers corresponding to this list will receive the status. A functional address is interpreted by TETRAPOL system using organization of the sender which must be provided by the DC.

The procedure for sending a status is as follows:

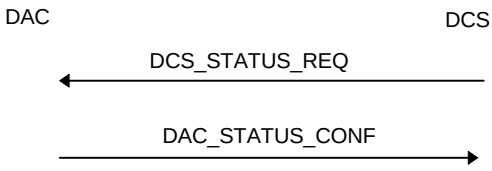

Figure 56: SMS sending

A free AG is needed for this SMS transmission. Any AG authorized for SMS may be used for sending. The AG shall be considered busy until DAC_STATUS_CONF message is received.

Parameters for DCS_STATUS_REQ are:

- Identification of SMS application
- message reference. Used to correlate the request and the acknowledge of emission (message DCS_STATUS_REQ and DAC_STATUS_CONF).
- Either a status code or a message text. Message text should contain ASCII characters limited to those that can be displayed or understood by the receiver. There is no control on the content of the message at R6 interface.

Address of the receiver. This shall be either an OG, a TETRAPOL address, or a functional address. No control (except that only one of the three addressing possibilities is used) is done at R6 interface.

- Priority of the SMS
- Encryption mode for sending the SMS (either mandatory or optional). If mandatory encryption is requested, SMS will not be sent if encrypted SMS cannot be sent. Otherwise (optional encryption requested), SMS is sent in clear mode if encrypted mode is not possible.
- Organization of the sender. To be used with functional address capabilities.

DAC_STATUS_CONF is sent as a reply from the DAC if the TETRAPOL system has taken the SMS into account. Reception of this message implies no delivery guaranty. An error may be sent in DAC_STATUS_CONF message:

Same three groups of errors as for voice services exist for SMS services

- error in the request from DCS. In this case, a new request with correct parameters may be asked.
  - Bad parameter value for DAC
  - Subscriber Problem
- TETRAPOL system unavailable. A temporary problem exist in TETRAPOL system. The request is correct but cannot be fulfilled at this moment or resources have been preempted. If tried later on , this request may succeed.
  - Network overload
  - Exceptional problem
  - Temporary problem
- TETRAPOL system failure. A persistent problem exist in TETRAPOL system which does not allow the service to be fulfilled
  - Network failure
  - Forbidden service
  - Invalid configuration for DAC
  - AG defectuous

5.10 Call advertising and voice traffic signalling

5.10.1 Scope

Call advertising flow is a spontaneous flow of information coming from TETRAPOL which signals noticeable events on group communications, such as activation and desactivation.

This flow may occur only on group communications that are setup in the TETRAPOL system. Informations delivered at R6 interface only concern group communications which are accessible through an access handler of the R6 interface, and corresponding to access rights of the AGs.

Voice traffic signalling is related to control of voice traffic in half duplex mode. It shall flow over R6-I1 interface. It may flow over R6-I3 interface.

It concerns private and group communications in which DC is involved.

For private communications, this means that an AG of the R6 interface has been chosen by TETRAPOL or by the DC at the setup of the private communication.

For group communications, this means that an AG of the R6 interface participates into the group communication.

5.10.2 Chronogram for voice communications

This applies to all voice communications from TETRAPOL system.

For private communications, there will be only one activation for the communication, beginning with the setup and ending with the release of the communication.

For group communications, setup of the communication is done in a step before its operational use. There may be several activations, preceded by a PTT request from a DC subscriber or a TETRAPOL subscriber.

The following chronogram indicates the relative state transitions related to activation-based trunked communications with activations, transmissions and talking party identity.

The first line indicates activations of the communication which means that resources are reserved by TETRAPOL system for the communication.

Second to fourth lines indicates activations of signals corresponding to specific wires over R6-I1 analog interface. For R6-I1 digital interface, corresponding QSIG facilities are delivered on D-channel when event (begin or end) occurs.

The fifth line indicates transmissions which means that speech is transmitted on the voice circuit .

The sixth line indicates messages delivered on R6-I3 interface from DAC to DCS related to these events.

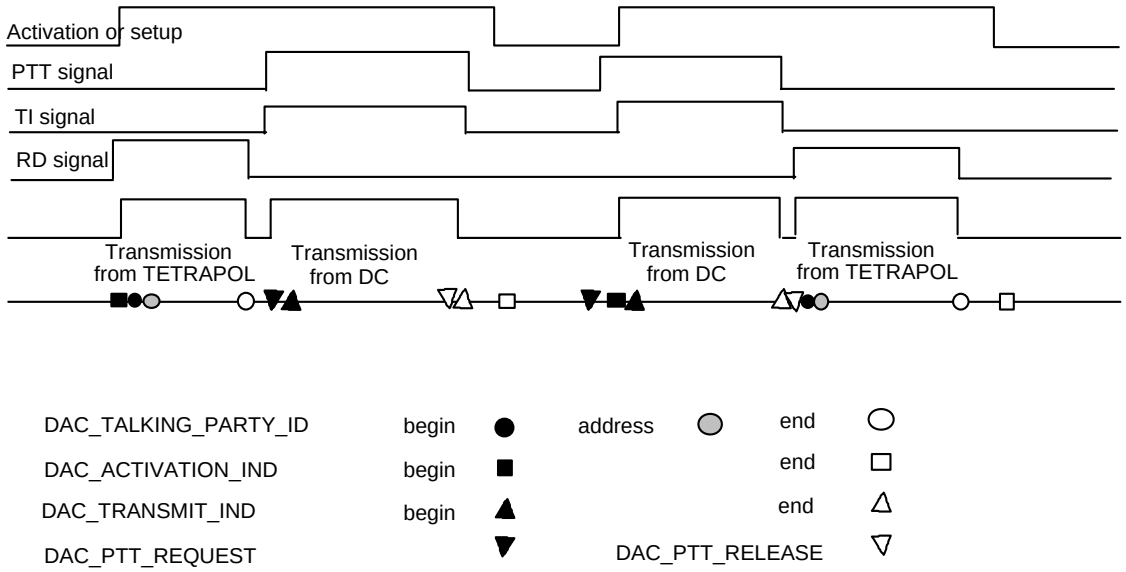

Figure 57: Chronogram for voice communications

For group communications, the first transmission beginning is synchronous to the begin of the activation. The end of the activation is shortly after the end of the last transmission.

For private communications, the first transmission beginning may be a little bit later than the begin of the activation.

5.10.3 Transmission from TETRAPOL

This clause applies to private communications and group communications including emergency group communications.

5.10.3.1 Beginning of a transmission

For a private communication, beginning of a transmission shall occur as soon as setup phase has ended (DAC_CONNECT message received on R6-I3 interface). It occurs on a PTT request from a TETRAPOL subscriber.

For a group communication, the first step before transmission of voice traffic is activation of the communication. This step may be processed on a PTT request from a TETRAPOL subscriber. If the communication is already activated, this step of activation shall not be processed on the PTT request, and the voice traffic may flow immediately.

Beginning of transmission preceded by a step of activation:

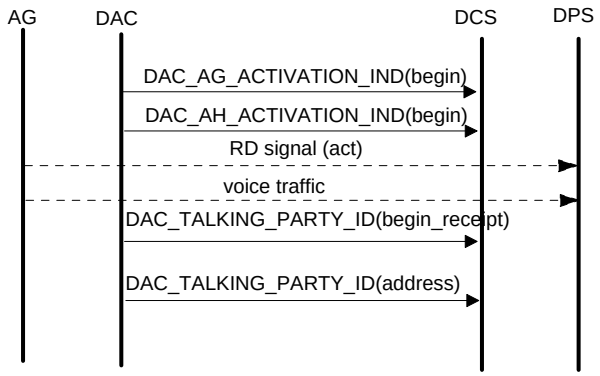

Figure 58: beginning of transmission from TETRAPOL with activation

Activation means that trunked resources necessary for the communication have been allocated by TETRAPOL. Allocation of resources to a group communication in which an AG of the R6 interface is involved shall be signalled on R6-I3 interface by DAC_AG_ACTIVATION_IND message.

Allocation of resources to a group communication in which an AH of the R6 interface is involved shall be signalled on R6-I3 interface by DAC_AH_ACTIVATION_IND message. This message is sent to DCS even if no AG of the R6 interface is participating into the communication. This message is sent to DCS once for each AH of the R6 interface involved in the group communication.

As an AG may participate only in group communication of the AH of the R6 interface, DAC_AG_ACTIVATION_IND and DAC_AH_ACTIVATION_IND will be both sent by the DAC for the group communications in which DC participates. They are sent at the same time.

As the state of encryption of a group communication may change from an activation to another, it is indicated in DAC_AG_ACTIVATION and DAC_AH_ACTIVATION_IND messages.

For private communications, state of encryption may not change during the communication and it is known when setup has been successfully completed.

Activation of RD signal on R6-I1 interface means that transmission of voice traffic may begin.

DAC_TALKING_PARTY_ID (begin receipt) indicates over R6-I3 interface the RD signal. It is delivered at the same time as RD signal activation over R6-I1 interface.

DAC_TALKING_PARTY_ID (address) indicates the address of the TETRAPOL subscriber who is talking (in the TETRAPOL addressing plan). A flag indicates whether the address of the talking party should be displayed or not.

Beginning of transmission not preceded by a step of activation:

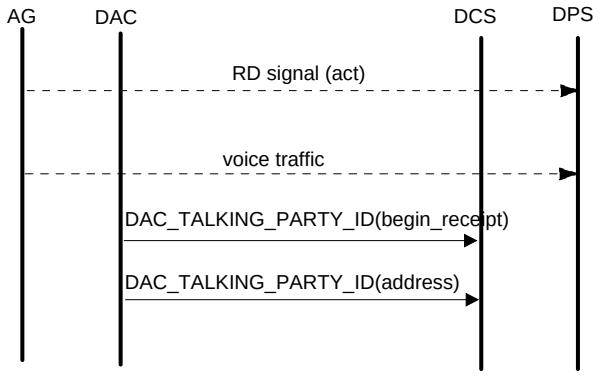

Figure 59: beginning of transmission from TETRAPOL without activation

5.10.3.2 Normal end of transmission

Normal end of transmission from TETRAPOL system occurs on a PTT release from a TETRAPOL subscriber. This step may be followed by another transmission phase from TETRAPOL or from DC systems, or by a deactivation of the group communication if no one requests for PTT.

End of transmission followed by a deactivation:

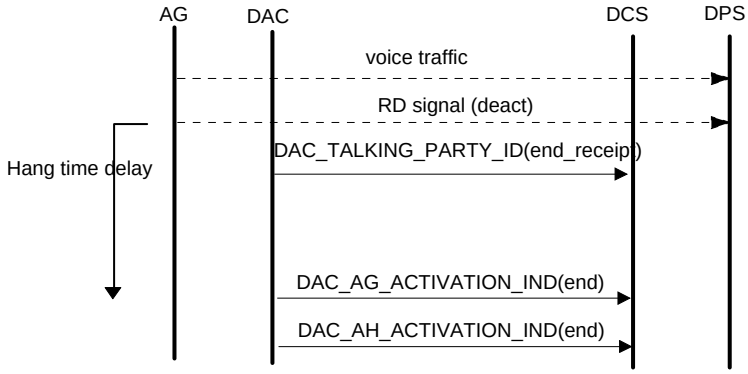

Figure 60: End of transmission followed by deactivation

If neither DC nor TETRAPOL subscribers request for PTT, a group communication is deactivated after hang time delay is elapsed.

5.10.3.3 Other cases for end of transmission

End of transmission may be caused:
- by withdrawal from DC side
- by withdrawal from TETRAPOL side,
- by a release of the communication from DC or from TETRAPOL
- by preemption of resources of R6 interface.

5.10.4 Transmission from DC

This clause applies to private communications and group communications including emergency group communications.

5.10.4.1 Beginning of a transmission

For a private communication, beginning of a transmission shall occur as soon as setup phase has ended (DAC_CONNECT message received on R6-I3 interface). It occurs on a PTT request from a DC subscriber.

For a group communication, the first step before transmission of voice traffic is activation of the communication. This step may be processed on a PTT request from a DC subscriber. If the communication is already activated, this step of activation shall not be processed on the PTT request, and the voice traffic may flow immediately.

The procedure for the push-to-talk requests applies for all group communications, except for a broadcast call not setup by the DC (PTT request transmitted from DC shall be ignored in this case).

Beginning of transmission preceded by a step of activation:

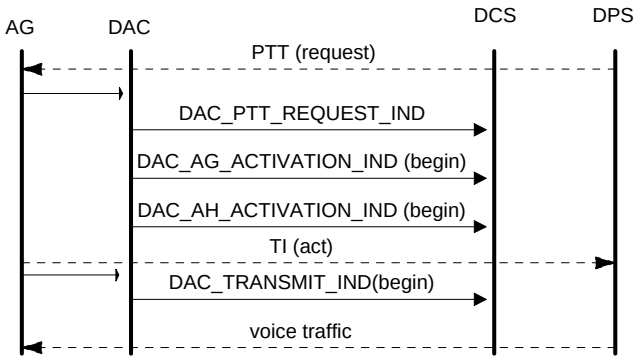

Figure 61: beginning of transmission from DC with activation

Reception of DAC_PTT_REQUEST_IND in DCS means that PTT request issued from DC has been taken into account by the AG. On reception of this request, resources are not yet allocated to the communication, and DC subscriber cannot already talk. If it does, voice traffic will not be transmitted inside TETRAPOL system.

The time between the PTT_REQUEST_IND and the effective activation of a group activation can last a few seconds.

Reception of DAC_AG_ACTIVATION_IND means that resources have been allocated inside TETRAPOL to the communication. Eventually, a cause gives a reason why an activation failed.

TI signal over R6-I1 interface means that voice traffic of the DC subscriber is transmitted inside TETRAPOL. An emission of DAC_TRANSMIT_IND over R6-I3 interface by DAC to DCS is made at the same time.

Beginning of transmission not preceded by a step of activation (communication already active):

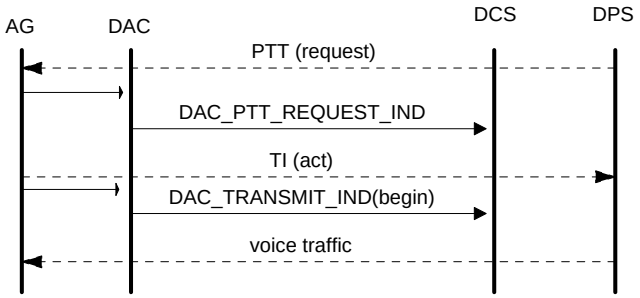

Figure 62: beginning of transmission from DC without activation

5.10.4.2 Normal end of transmission

Normal end of transmission from DC system occurs on a PTT release from a DC subscriber. This step may be followed by another transmission phase from TETRAPOL or from DC systems, or by a deactivation of the group communication if no one requests for PTT.

End of transmission followed by a deactivation:

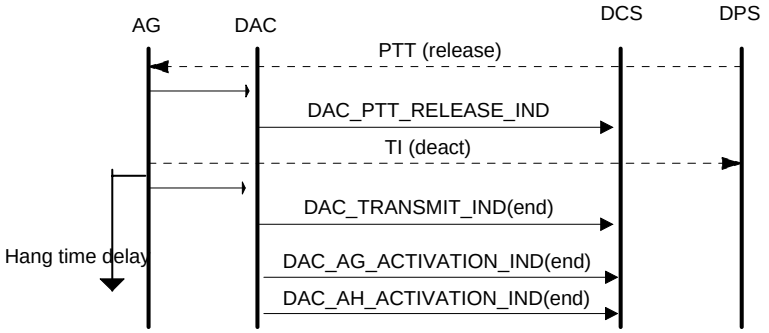

Figure 63: End of transmission from DC followed by deactivation

DAC_PTT_RELEASE_IND indicates that PTT release from DC side has been taken into account by TETRAPOL.

TI signal (deact) on R6-I1 interface and DAC_TRANSMIT_IND (release) on R6-I3 interface signals that no more transmission of voice traffic to TETRAPOL is possible.

DAC_AG_ACTIVATION (end) and DAC_AH_ACTIVATION_IND (end) signals that TETRAPOL has released trunked resources allocated to the communication.

5.10.4.3 Other cases for end of transmission

End of transmission may be caused:

- by withdrawal from DC side
- by withdrawal from TETRAPOL side,
- by a release of the communication from DC or from TETRAPOL
- by voice inactivity
- by an anti gossip timeout managed by TETRAPOL
- by preemption of resources of R6 interface.

6. Fallback mode procedures

6.1 R6 interface fallback modes

6.1.1 DCS isolated from its Work Positions

If DCS is isolated from all or a part of its working positions, it cannot propose incoming calls from TETRAPOL to its dispatchers.

In order to authorize these calls to be rerouted elsewhere (on wire connected terminals for example), it is possible for DCS to request that no incoming calls shall be accepted an AG or by all the AG of an AG-trunk.

This request is possible using DCS_CONFIG message. Parameters for this message are:

- identification of the AG or the AG-trunk which must accept or not accept incoming calls
- type of incoming calls to be accepted or refused (voice calls or data calls (SMS))

In this case, incoming calls coming from TETRAPOL and adressed by an implicit address can be rerouted on another terminal of the implicit address.

In order to accept incoming calls after an interdiction, a new DCS_CONFIG or an AG reset message shall be sent by DCS to DAC.

6.1.2 DAC isolated from DCS

When the DAC is isolated from the DCS (TCP/IP link between DAC and DCS is released), and links between AGs and DPS are still present, on-going group and private communications shall proceed but no new communication is accepted.

There is no possibility that a new communication can be installed on an AG by TETRAPOL nor by DC while DAC-DCS link is broken.

If an incoming communication reaches the AG of the R6 interface:

- Either this communication has been adressed to DC using an implicit address
  presentation of the call will be refused by the AG in order that call can be rerouted on another terminal of implicit address
- Or this communication has been addressed to DC using an explicit address of an AG
  The communication will be accepted by the AG and will be lost.

In case of a private communication, if a withdrawal from DC side is requested, nothing happens and from AG point of view, it will continue to be busy into the communication.

In case of a private communication, if a withdrawal from TETRAPOL side is requested, the private communication is released from AG point of view, and it will reach a free state. The withdrawal information will not arrive to DCS.

At reconnexion, AG state may be busy or not in a communication. It is DC role to manage reinstallation of communications. If an AG is busy, a DAC_END message will be sent by DAC to DCS.

In order to be sure that an AG is free, DC can request for AG reset at reconnexion.

6.1.3 AG isolated from the DAC

In this case, AG is isolated from DAC but DAC-DCS link is still present. The DAC spontaneously informs the DCS that the AG is not reachable (DAC_CONFIGURATION_IND message with a state "not registered" for the AG).

The AG stays in the current communication, either private or group communication.

At reconnexion, AG state may be busy or not in a communication. It is DC role to manage reinstallation of communications. If an AG is busy, a DAC_END message will be sent by DAC to DCS.

In order to be sure that an AG is free, DC can request for AG reset at reconnexion.

6.1.4 AG isolated from the DPS

The link between AG and DPS is not supervised by the DAC and no information is available to the DCS. Therefore, no action is taken in case of failure of this link.

It is DPS role to supervise this link.

6.1.5 AG isolated from the SwMI

The DAC signals to the DCS (message DAC_CONFIGURATION_IND with an AG state "not registered") that the AG is defectuous.

The DAC requests automatically for registration of the AG. When the AG is registered, the DAC signals it spontaneously to the DCS (message DAC_CONFIGURATION_IND with an AG state "registered").

6.2 TETRAPOL fallback modes

6.2.1 Notification of TETRAPOL fallback modes

FBM1 (inter BN disconnected mode) is not delivered at R6 interface. When this state is reached, a failure of a communication setup or ongoing may occur, and R6 interface will be notified with this failure.

FBM31 (RSW disconnected mode) and FBM32 (BSC disconnected mode) are spontaneously notified at R6 interface using local control flow. If an AH is in this FBM state when connection between DAC and DCS is established, AH state will be delivered with other attributes on DCS request.

A notification of entry and exit from fallback mode is sent for every AH in FBM described in the static model of the R6-I3 interface.

Some reduced voice services are offered during these fallback modes. They are described in the relevant clauses of call control flow.

6.2.2 FBM2 MSW disconnected mode and FBM 31 RSW disconnected mode

6.2.2.1 Entry into FBM2 or FBM31

Entry into these FBM has no impact on AG behaviour. Registration of every AG to TETRAPOL system remains the same from R6 interface point of view.

For the AH which enter into FBM, a notification is sent over R6 interface.

All the flows of information over R6 interface are still available in this fallback mode. Some services are still available with a reduced coverage.

There is no impact on group communication lists available with system monitoring flow. The lists of group communications will be the same, but the coverage may be reduced. As the coverage of the group communication is not sent at R6 interface, there will be no specific notification.

Figure 64: Notification of entry into FBM2 or FBM31

This has no impact on the communications available through other AH of the R6 interface in normal mode.

6.2.2.2 Exit from FBM2 and FBM31

Exit from FBM31 and return to normal mode has following impacts on R6 interface behaviour :

- Unregistration of all AG linked to the AH which exits from FBM31
- Notification of empty lists of group communications per AG trunk related to the AH exiting from FBM31 (system monitoring flow)
- Registration of all AG linked to the AH which exits from FBM31
- Notification of AH working in normal mode
- Notification of lists of accessible group communication in normal mode per AG trunk (system monitoring flow)

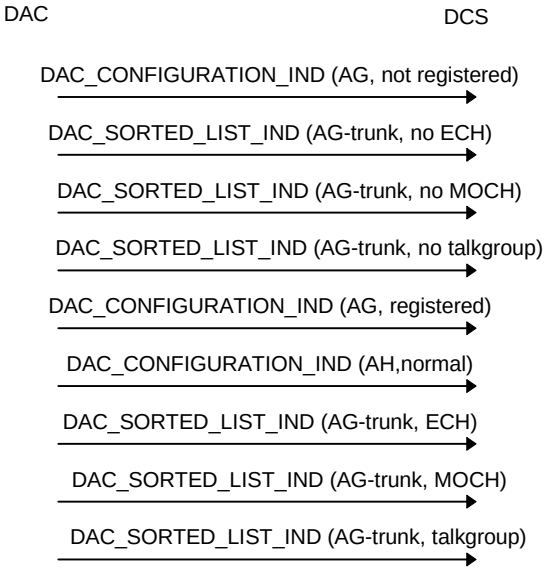

Figure 65: Exit from FBM31 and back to normal mode

Only impact of exit from FBM2 is AH notification of working in normal mode. This means that a complete coverage in the RN of the AH is available for group communications.

6.2.3 FBM32 BSC disconnected mode

This mode may only concern radio AG attached to radio cells.

6.2.3.1 Entry into FBM32

Entry into FBM32 is notified at R6 interface per AH of the R6-I3 interface model. It has got following impacts on R6 interface behaviour:

- Unregistration of all AG linked into the AH which enters into FBM32 (state of AG is not registered)
- Notification of empty lists of group communications per AG trunk related to the AH in FBM32 (system monitoring flow)
- Registration of all AG linked to the AH which enters into FBM32 (state of AG is registered)
- Notification of AH working in FBM32 mode

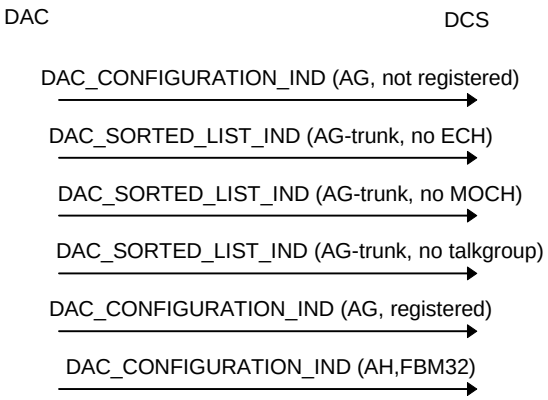

Figure 66: Entry into FBM32 from normal mode

Local control flow is still available without any restriction.

Circuit control flow is still available except for encryption and forward control of the AG.

System monitoring flow is available, but will deliver empty lists.

Data services are not available.

Call advertising and voice traffic signalling are still available for voice communications that can be used in this mode.

This has no impact on the communications available through other AH of the R6 interface in normal mode.

6.2.3.2 Exit from FBM32

Exit from FBM32 and return to normal mode has following impacts on R6 interface behaviour:

- Unregistration of all AG linked to the AH which exits from FBM32
- Registration of all AG linked to the AH which exits from FBM32
- Notification of AH working in normal mode
- Notification of lists of accessible group communication in normal mode per AG trunk (system monitoring flow)

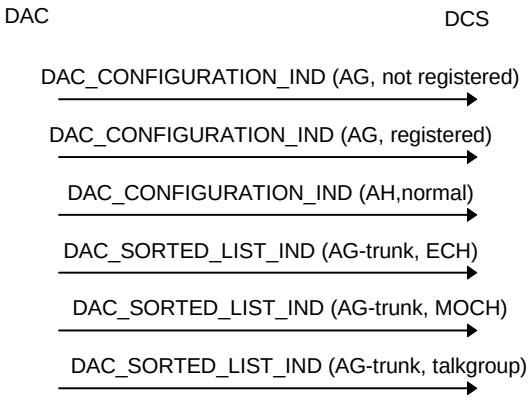

Figure 67: Exit from FBM32 and back to normal mode

Access to private communications and data services is accessible as soon as notification of AH working in normal mode is received.

Access to group communications is available only when lists of communications have been delivered.

7. History

Document history		
Date	**Status**	**Comment**
20/08/1996	Version 0.0.1	Split from early version of PAS Part 5-2 for digital dispatch centres
30/09/1996	Version 1.0.0	Version proposed, then removed from PAS Phase 1
25/04/1997	Version 1.0.1	Features for both digital and analog dispatch centres
30/05/1997	Version 1.0.2	Adaptation of the status services so that short datagrams be on a different flow.
20/01/98	Version 1.0.3	Same update as in air interface (part 3)
16/04/98	Version 1.0.4	Enhancement for configuration, initialization
29/04/98	Version 1.0.5	Review of notations
27/05/98	Version 1.0.6	Review after meeting
06/07/98	Version 1.1.0	Update following approval review
26/08/98	Version 1.1.1	Suppression of DAC configuration by the DCS
11/02/99	Version 1.1.2	Precisions on scanning service precisions on SwMI preemptions for AG engaged in group communication
27/08/98	Version 1.2.0	Version 2 of interface.
	Version 1.2.1	New architecture of document. Includes new definition of data flows over R6-I3 interface.
06/01/99	Version 1.3.0	Version 3 of interface, SMS services
24/03/99	Version 1.3.1	Review after meeting
06/08/99	Version 1.3.2	Minor editorial changes
07/03/00	Version 1.3.3	TPI inhibition, FBM 2 notification, subaddress for outgoing private call, keep alive mechanism
10/04/00	Version 2.0.0	Tetrapol Working Group Approval