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BSS-MSC Interface - Interface Principles

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1. Reason for changes

No changes since the previously distributed version.

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BSS-MSC Interface - Interface Principles

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PREFATORY NOTE

ETSI has constituted stable and consistent documents which give specifications for the implementation of the European Cellular Telecommunications System. Historically, these documents have been identified as "GSM recommendations".

Some of these recommendations may subsequently become Interim European Telecommunications Standards (I-ETSs) or European Telecommunications Standards (ETSs), whilst some continue with the status of ETSI-GSM Technical Specifications. These ETSI-GSM Technical Specifications are for editorial reasons still referred to as GSM recommendations in some current GSM documents.

The numbering and version control system is the same for ETSI-GSM Technical Specifications as for "GSM recommendations".

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1 SCOPE

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

The set of fixed equipment accessed from the MSC through one particular instance of the interface will be later referred to as a Base station system (BSS). An BSS ensures the coverage of n cells, where n can be 1 or more.

The function of an BSS may be further subdivided into a control function, performed by one base station controller (BSC) and a transceiving function,performed by "n" base station transmission equipments (BST), one for each cell. However, the study of such a split is outside the scope of the 08.0x series of recommendations, where the BSS will be considered as a whole.

The BSS-MSC interface defined in the 08 series of recommendations is designed to support a wide range of possible architectures on both sides. Characteristics like the physical location of the transcoders/rate adaptation inside the BSS (either integrated into the transceivers or very near to the MSC) or the use of traffic or signalling concentration at either side are left to the operators choice. Annex 1 to this recommendation contains guidance information concerning the use of remote mobile switching units, which for the purposes of this recommendation are considered as part of the MSC.

Direct connection between two BSSs is not supported by this interface.

This interface is based on the use of 1 or more 2048kbits\s digital transmission system interfaces. Each 2048kbits\s interface provides 31*64kbits\s channels which can be used for traffic or signalling as the operator requires.

The signalling is layered, terminology similar to that in the OSI reference model is used in this series, however the layers referred to are not identical to the equivalently named layer in the OSI model.

This interface is defined at the boundary of the MSC and has a per channel bit rate of 64kbits/s, but the net radio path traffic channel is at a rate of less than 16kb/s. A transcoder or rate adapter function is thus needed for the rate conversion. The interface is designed such that the transcoding or rate adaptation function may be geographically situated at either the MSC site or the BSS site, however the transcoder is considered to be part of the BSS.

The interface has been designed around the aims of recommendation 08.01 allowing each component and the system as a whole to evolve.

2 FUNCTIONAL DIVISION BETWEEN BASE STATION SYSTEM (BSS) AND MSC

FUNCTIONAL SPLIT

Item/Task	BSS	MSC,VLR,HLR
Terrestrial Channel Management		
channel allocation		X
blocking indication	X	
test call	(O&M group to define)	
Radio channel management		
Radio channel configuration management	X	
TCH management		
channel allocation (choice)	X	
link supervision	X	
channel release	X	X(invoked by MSC)
frequency hopping management	X	
idle channel observation	X	
power control	X	
BCCH/CCCH management		
scheduling of messages	X	
DCCH management		
link supervision	X	
channel release	X	X (invoked by MSC)
power control	X	
DCCH allocation	X	
Radio resource indication		
report status of idle channels	X	
Channel coding decoding,		MSC defines
on the basis of call type	X	call type
Transcoding/rate adaptation	X	-..-
Interworking Function (data calls)		X
Measurements		
reported from MS	X	X
uplink	X	X
traffic		X

FUNCTIONAL SPLIT

Item/Task	BSS	MSC,VLR,HLR
Handover		
internal (within one cell){{if provided}}		MSC informed
internal (between cells) {{if provided}}	X	..
external recognition radio reason	X	
external recognition traffic reason		X
decision		X
execution		X
Mobility Management		
authentication		X
location updating		X
paging		X
DRX paging (scheduling)	X	
Call control		X
User data encryption	X	Key from MSC
Signalling element encryption	X	Key from MSC

2.1 TERRESTRIAL CHANNEL MANAGEMENT

2.1.1 Terrestrial Channel Allocation

Terrestrial channel allocation will be handled in the following manner;

The MSC will consider the link to the BSS as a route on "n" channels. Within this route, certain of the channels may not be able to support all types of traffic (e.g. data calls or half rate coder calls). The MSC shall therefore ensure that the terrestrial channel chosen is able to support the type of call involved, this information is held in data.

The MSC shall choose the terrestrial channel to be used.

2.1.2. Blocking of Terrestrial Channels

Since the MSC chooses the terrestrial channel the BSS shall be able to remotely block the terrestrial channel and remove it from service. This is signalled across the BSS/MSC interface using the appropriate signalling exchange as defined in rec. 08.08.

Local blocking of terrestrial channels at the MSC may be supported by the MSC and will result in the concerned channels not being chosen, no information flow across the interface concerning this type of blocking.

2.1.3. Test Calls

In order to support test calls, there will on some occasions be a need to force the use of particular radio equipment, or terrestrial resource, therefore the MSC may, for O and M reasons overrule the radio channel choice made by the BSS.

2.2. RADIO CHANNEL MANAGEMENT

2.2.1. Channel Configuration Management

The channel configuration management will be controlled between BSS and maintenance centre, the MSC holding no direct data concerning the allocation of radio timeslots etc.

2.2.2. Radio TCH Management

2.2.2.1. Radio Channel Allocation

The BSS shall choose the radio channel to be used (on the appropriate cell in the case of multi-cell BSSs), based on information received from the MSC, which defines the channel type, channel coding and all other parameters relevant to defining channel type. The chosen radio channel shall be connected to the terrestrial channel in order to support the call. This connection mechanism is not further defined in these recommendations.

2.2.2.2. TCH Radio Link Supervision

Radio link supervision of dedicated radio resources shall be the responsibility of the BSS. If communication with the mobile is lost then the BSS can request that the call be cleared.

2.2.2.3. Frequency Hopping Management

Frequency hopping management shall be performed by the BSS. That is the BSS shall store and transmit all hopping parameters for the cell(s) that it controls, the hopping shall be performed such that it is not visible on the BSS/MSC interface.

2.2.2.4. Idle Channel Observation

The quality of idle radio channels shall be measured by the BSS and a condensed form of the information passed back to the MSC.

2.2.2.5. TCH Power Control

All power control functions shall be performed between MS and BSS. No real time power control commands shall be sent across the BSS/MSC interface.

2.2.2.6. TCH Channel Release

The release of a dedicated resource is primarily controlled by the MSC. However for radio propagation reasons the BSS can request of the MSC that a call be released. The necessary protocols are defined in Rec. 08.08.

2.2.3. BCCH CCCH Management

All BCCH data shall be either stored at/derived locally by the BSS.

CCCH random accesses shall be controlled autonomously by the BSS, paging messages shall be received from the MSC via the BSS/MSC interface.

2.2.3.1. Scheduling of BCCH and CCCH messages

The scheduling for all BCCH and CCCH messages shall be performed by the BSS.

2.2.4. DCCH Management

2.2.4.1. DCCH link supervision

Radio link supervision of dedicated radio resources shall be the responsibility of the BSS. If communication with the mobile is lost then the BSS can request that the call be cleared.

2.2.4.2. DCCH Channel Release

The release of a dedicated resource is primarily controlled by the MSC. However for radio propagation reasons the BSS can request of the MSC that a call be released. The necessary protocols are defined in Rec. 08.08.

2.2.4.3. DCCH Power Control

All power control functions shall be performed between MS and BSS. No real time power control commands shall be sent across the BSS/MSC interface.

2.2.4.4. Radio Channel Allocation

The BSS shall choose the DCCH to be used (on the appropriate cell in the case of multi-cell BSSs).This shall be performed initially after the random access to the CCCH has been made by the MS. The chosen DCCH may at a later stage in the call be connected to the terrestrial channel in order to support the service, this is controlled by the appropriate indications in an assignment message from the MSC.

2.3. RESOURCE INDICATION

The status of idle radio channels is reported to the MSC using the protocol described in rec. 08.08.

2.4. CHANNEL CODING DECODING

The encoding decoding and interleaving shall be performed by the BSS. The type of channel coding and interleaving is derived from the information in the assignment message from the MSC.

2.5 TRANSCODING/RATE ADAPTATION

Rate adaptation or transcoding shall be performed by the BSS. the selection of the appropriate function shall be based on information received from the MSC.

2.6 INTERWORKING FUNCTION (DATA CALLS)

The interworking function required for data calls to other networks shall be performed on the MSC side of the MSC/BSS interface.

2.7. MEASUREMENT INFORMATION

2.7.1. Measurement information reported from the MS

Measurement information reported from MSs with dedicated radio resources shall be received by the BSS, preprocessed and the results may be transmitted to the MSC as described in rec. 08.08.

2.7.2. Uplink Measurement Information

The BSS shall produce uplink information for transmission across the BSS/MSC interface. The information to be provided is defined in rec. 08.08

2.7.3. Traffic Information

Traffic information concerning the traffic environment outside an BSS is not passed from MSC to BSS.

2.8. HANDOVER

Handovers (both internal and external) can occur for one of several reasons e.g. radio propagation, traffic distribution, O and M activity, equipment failure.

2.8.1. Internal Handover Within One Cell

Internal handover within one cell can be supported within an BSS. It is optional for an BSS to be able to perform autonomous internal handover.

The MSC will be informed when an autonomous internal handover has been completed (see 08.08)

2.8.2. Internal Handover Between Cells

Internal Handover between cells on the same BSS (for multi cell BSSs) can be supported within an BSS. Multi cell BSSs would normally be expected to support internal inter cell handover, however it is optional that they do so.

The MSC will be informed when an autonomous internal handover has been completed (see 08.08)

2.8.3. External Handover

The definition of external handover is given in recommendation 01.04. This type of handover includes inter MSC handover as discussed in recommendation 03.09.

2.8.3.1. Recognition that a handover is required for a radio reason

The BSS shall be able to generate an indication that a handover is required to the MSC using the protocols defined in rec. 08.08.

No additional guidance is given in the 08.0X series concerning the algorithm within the BSS that generates either an internal handover, or an indication to the MSC that an external handover is required.

2.8.3.2. Recognition That A Handover Is Required For A Traffic Reason

Within a multi BSS area only the MSC has a perspective of the overall traffic loading. The MSC shall therefore originate inter BSS traffic handovers due to traffic reasons.

2.8.3.3. Decision of Target Cell

The final choice of the target cell in an external traffic handover shall be made by the MSC, based on information received from the BSS.

2.8.3.4. Execution

Having received an indication from an BSS that an external handover is required, the decision of when and whether an external handover should take place shall be made by the MSC.

2.9 MOBILITY MANAGEMENT

All transactions concerning mobility management shall take place transparently between the MS and MSC\VLR\HLR, using the DTAP protocols described in rec. 08.08 and rec. 08.06. The only exception to this rule is that of paging which is scheduled by the BSS on the appropriate cell.

2.10 CALL CONTROL

Call control will be the responsibility of the MSC\HLR\VLR.

2.11. SECURITY FEATURES

Information on security aspects are found in Rec. 03.20. The BSS/MSC interface supports all of the required interchange of encryption keys.

2.11.1. User Data Confidentiality

Encryption and decryption of user data (e.g. speech) takes place within the mobile station and within the BSS. In order to decrypt/encrypt user data the encryption device used for the call must be loaded with the relevant key. This is supplied by the MSC.

2.11.2. User Identity Confidentiality

This feature is supported by using a TMSI rather than an IMSI, over the radio path. The translation between TMSI and IMSI is performed at the MSC and within the mobile. Both TMSI and IMSI are carried transparently by the BSS-MSC interface as far as possible.

2.11.3. Signalling Information Confidentiality

As for user data.

2.11.4. Authentication of Users

Authentication is carried out at the mobile and at the MSC/VLR/HLR. The MSC to BSS interface is required to transport the necessary challenge and response messages.

3. TRANSCODER\RATE ADAPTER INTEGRATION

The transcoder will be functionally integrated into the BSS. It is not considered to be a stand alone piece of equipment. The control of the transcoder will therefore take place directly via the BSS, an explicit control interface between BSS and transcoder will not be defined.

Dependent on the relative costs of transmission plant for a particular administration, there is an economic benefit, for larger cells and certain network topologies,in having the transcoder positioned at the MSC site. However, for smaller cells there may actually be a cost penalty due to special multiplexing.

When the transcoder is geographically sited at the MSC site, it shall still be considered art of the BSS, and as such is on the BSS side of the BSS-MSC interface.

4. MULTIPLEXING OF COMMON AND DEDICATED CONTROL CHANNELS

Common and dedicated control channels will be used for the same call on the radio path. These control channels (ACCH, DCCH and CCCH) will be multiplexed onto one (or more if security or traffic levels warrant it) common signalling channel(s) between the BSS and MSC, this multiplexing function will reside at the BSS. The exact method by which messages are addressed to mobiles, and are sent via CCCH or ACCH is defined in recommendation 08.06 and 08.08.

It should be noted therefore that the data links across the air interface are terminated at the BSS.

All scheduling of messages via the air interface is controlled by the base station, flow control is therefore required from BSS to SC to prevent overload of the transmission buffers, this is further detailed in recommendation 08.08 and 08.06.

5. CLASSES OF SIGNALLING MESSAGES

The signals between BSS and MSC are classified under three headings

i) DTAP messages
ii) BSS management
iii) BSS O&M

} BSSAP messages

Where DTAP BSSMAP and BSSAP are as defined in recommendation 08.08.

At layer 3 call control messages will as far as possible pass transparently through the BSS. Discrimination between BSSMAP, DTAP, and BSSOMAP messages is detailed in 08.06 .

6 SUPPORT OF SERVICES AND FEATURES OTHER THAN SPEECH

6.1 Data Services

In order to ensure that the requirements of 03.10 are met, the support of data services will entail the following 7 actions being taken:

i. The speech coder being deactivated in the mobile.

ii. A rate adaptation function being activated in the mobile.

iii. An appropriate channel coding being activated in the mobile radio subsystem.

iv. An appropriate channel coder being activated in the BSS.

v. A rate adaptation function being activated in the BSS.

vi. Any echo control in the MSC being by-passed or disabled.

vii. An appropriate network interworking function being invoked.

The MSC to BSS interface will support all necessary signalling for this to be achieved.

6.2 Supplementary Services

All signalling concerned with supplementary services is passed transparently through the BSS via the DTAP.

7. INTERFACE STRUCTURES

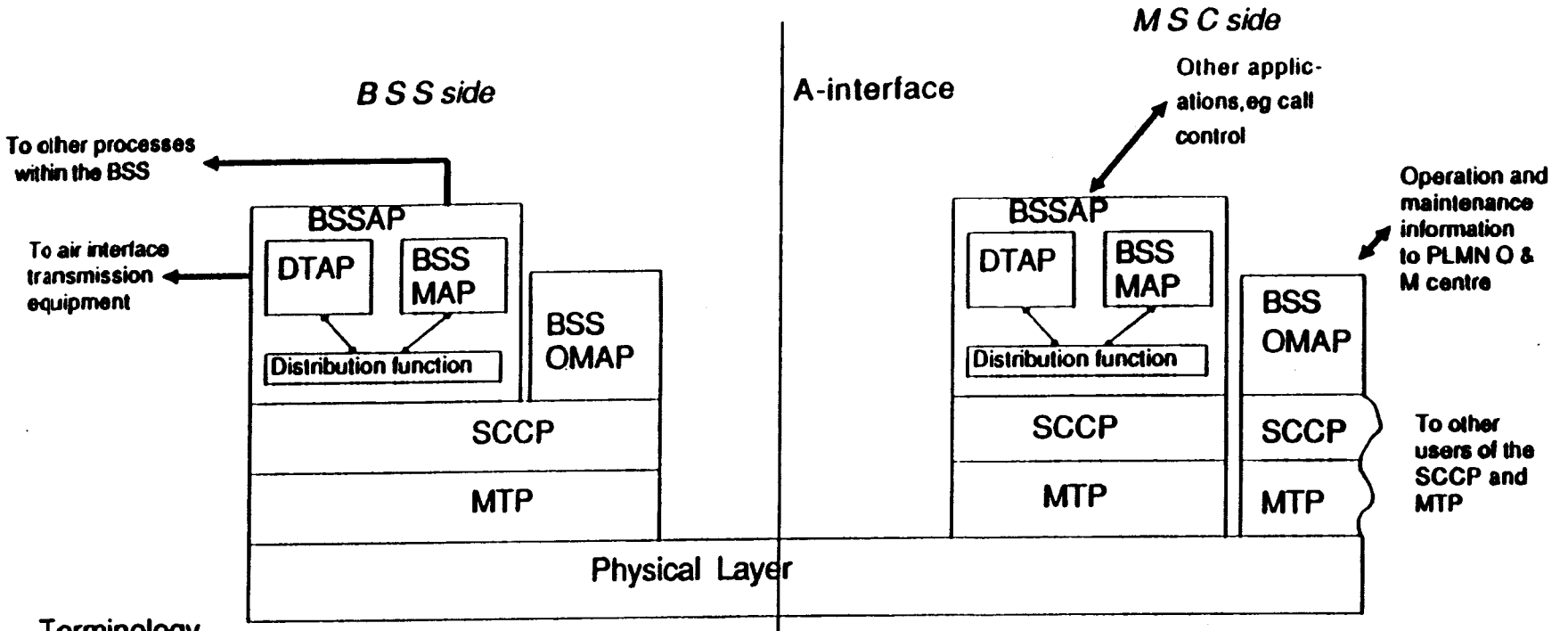
The definition of the MSC to BSS interface follows a layered approach. This is shown in figure 1.

In the case of a digital link being used between the BSS and MSC, the signalling will be carried in one of the 64kbits/s timeslots.

8 OPERATION AND MAINTENANCE

Operation and maintenance information is required to flow between the BSS and O & M functions. The BSS to MSC interface provides for this type of information see {{08.09}} .

FIGURE 1
SIGNALLING PROTOCOL REFERENCE MODEL



Terminology

DTAP ; direct transfer application part
BSSMAP : BSS management application part
BSS OMAP : Operation and maintenance application part
SCCP : signalling connection control part
MTP : message transfer part
BSS : Base station system
MSC : Mobile services switching centre

Note: X.25 can be used for transferring O and M information

ANNEX 1

REMOTE MOBILE SWITCHING UNIT (RMSU)

1. Introduction

Between the MSC and some of the BSS sites served by this MSC , it may be advantageous to include a line concentrator, an RMSU. The main purpose of introducing this unit is to reduce the number of terrestrial circuits needed between BSS site and MSCs (signalling and traffic circuits). The benefits of introducing an RMSU will depend on :

- Relative costs of the transmission plant for the particular administrations
- The costs involved in operating the RMSU
- The complexity of the RMSU, i.e. if it allows interworking with the ISDN or the PSTN for mobile originated calls.

In the GSM recommendations the RMSU will be regarded as a remotely controlled part of the MSC, and therefore no detailed specification of the RMSU or the signalling functions needed between the RMSU and the MSC will be given.

2. Functions Provided by the RMSU

Below is listed some examples of functions which may be provided by the RMSU:

- Setting up and clearing of circuits to the BSS and the MSC (remotely controlled by the MSC).
- Switching of the circuits between MSC and the various BSSs.
- Blocking and unblocking of circuits.
- Possibly interworking with the PSTN or ISDN for mobile originated calls, including information exchange with remote control from the MSC.
- Operation and maintenance functions of the RMSU.

3. General Requirements

In order to be able to establish an BSS configuration without using an RMSU, and then later on introducing this unit, the interface between the BSSs and the RMSU should have the same characteristics as the interface between an BSS and an MSC.

The number of subscribers served by an RMSU will be large compared to the number of subscribers served by a single BSS. Therefore, if the RMSU or the signalling links between the RMSU and the MSC go down, this will have a serious impact on the mobile service in a large geographical area.

The implementation of the RMSU and the signalling between the RMSU and the MSC therefore has to be made in such a way that the overall reliability requirements specified for the MSC are fulfilled.

Some O and M facilities may be required in the RMSU, and the necessary signalling between the RMSU and the O and M functions has to be provided.