Author	Date	REFERENCE	
MORANE	17 May 2000	F 10 T 6001 3	
Name of WP/Activity WP 22: Review of Form Fit Functional Specification			**Contract:** **WP/ACT:**
Company/organisation MORANE		**Team**	**MORANE** **WP/ACT: 22**

FFFS FOR

LOCATION DEPENDENT ADDRESSING

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EVOLUTION SHEET

Version	Date	Author	MODIFICATION
A	08/07/1996	AMC	Creation
B	20/08/1996	AMC	Editorial changes
C	09/09/1996	AMC	Editorial changes
1	25/09/1996	AMC	First approved version
1A	30/06/1997	Siemens	SDL added
2	25/07/1997	Siemens	Editorial changes
3	31/07/2000	MORANE	Specification update third issue

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1. SCOPE

This Form Fit Functional Specification (FFFS) specifies the functions for all GSM equipment involved in the realisation of the location dependent addressing.

The location dependent addressing service ensures that calls from a mobile subscriber are routed to the correct controller connected to an external network. The correct controller is defined by the location of the calling mobile subscriber.

The called party on the fixed network side is an ISDN party or a non-ISDN party and is called by a functional number, which identifies its function (for instance primary train controller, electricity supply controller, secondary controller.

The call is typically originated by the train driver using the cab radio, but the location dependent routing should be ideally supported for other functional calls, using other terminals and/or train application functions.

2. NORMATIVE REFERENCES

[1] MORANE FIS, Location Dependent Addressing, F 12 T 6001

[2] MORANE SSRS A 04/02 T 6002

[3] EIRENE SRS version 12.0, ITA 0780018

[4] GSM 05.08 8.2.1 Digital cellular telecommunications system (Phase 2+); Radio subsystem link control

[5] 3GPP TS 24.087 3.0.0 User-to-User Signaling (UUS) - Stage 3

[6] 3GPP TS 24.008 3.3.0 Mobile radio interface layer 3 specification, Core Network Protocols - Stage 3

[7] GSM 08.08 v8.3.0 BSS - MSC interface Layer 3 specification

3. DEFINITIONS AND ABBREVIATIONS

BCD	Binary Coded Decimal
BSC	Base Station Controller
BSS	Base Station System
CDPA	CalleD Party Address
CFU	Call Forwarding Unconditional
CLIP	Calling Line Identification Presentation
FN	Functional Number
FNUT	Fixed Network User Terminal
CGI	Cell Global Identification
GCR	Group Call Register
GMSC	Gateway MSC
GPS	Global Positioning System
GSM	Global System for Mobile Communications
GSM-R	GSM Rail
IAM	Initial Address Message
IN	Intelligent Network
ISDN	Integrated Service Digital Network
MOC	Mobile Originating Call
MS	Mobile Station
MSC	Mobile Switching Centre
MT	Mobile Termination
MTC	Mobile Terminating Call
NSS	Network Sub System
OMC	Operation and Maintenance Centre
PABX	Private Automatic Branch eXchange
TFN	Train Functional Number
UUS1	User to User Signalling
VGCS	Voice Group Call Service

4. MAIN CONCEPTS

The address of the controller to be called depends on the exact location of the mobile subscriber. Therefore the processing of location information, provided by external location systems (e.g. balises or other reliable systems) can be used for more accurate positioning or GSM cell specific routing can be used for a less granular approach or as a backup mechanism to more accurate positioning systems.

The location information provided by external location systems is handled by applications and has no impact on the functions required from GSM equipment. But these applications are associated to the mobile termination and/or to the fixed network user terminal. The application gets access to telecommunication services by using interfaces to the mobile termination and the fixed network user terminal.

The telecommunication services have to be provided by the GSM-R network independently from the external location systems. This ensures a flexible solution independent from different location systems.

But despite of different external location systems, it has to be taken into account that there will be tracks as well in future without any kind of an external location system or with location systems providing no complete location information, for instance tracks without balises or railway areas approximate to radio cells.

In this case the accuracy of the location determination is limited to the location information available within the radio system. That means cell specific procedures have to be provided by the GSM-R network to realise location dependent addressing. This is possible by using special functional numbers (Short Codes) to trigger the MSC to evaluate the Cell Global Identification (CGI) for the cell specific routing. This cell specific procedure is defined in this specification. It describes a new kind of cell specific routing based on the normal MOC setup procedures according [6] by using the Short Codes mentioned above. See figure 1.

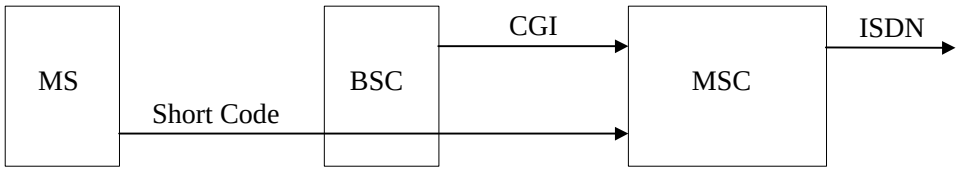


Figure 1: Cell Specific Routing

But in any case the cell re-selection procedures according [4] are applied by the mobile termination in an unchanged way.

This solution can be transparently combined with the above mentioned solution for tracks equipped with external location systems to provide additional accuracy and a back-up solution when the external system is available and a basic location address capability when the track is not equipped with external location system.

5. GENERAL ARCHITECTURE

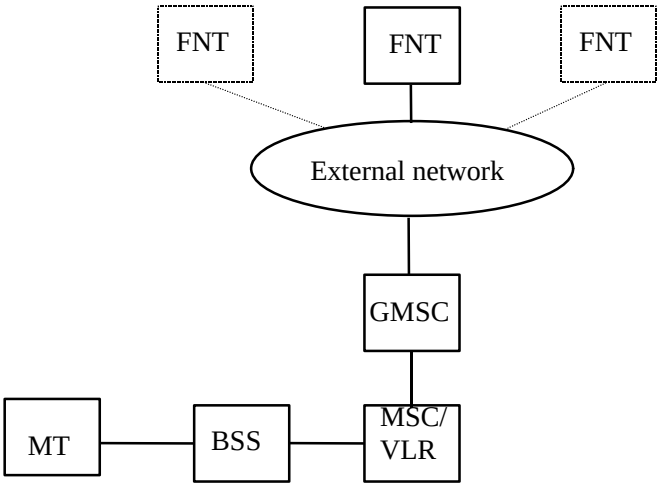
The signalling for the location dependent routing between the entities shown in figure 2 shall always proceed as for a normal mobile originated call establishment.
Always the MSC, connected to the cell within the call is initiated, has to determine how to handle the call.

If the initial signalling from the originator informs the MSC about a normal call setup, the MSC shall determine by analysing the Called Party BCD Number if

- a mobile originated call setup by applying cell specific routing triggered by Short Codes or
- a normal mobile originated call setup (FN as controller address is used)

is required.

If cell specific routing is applied, the entry within the MSC database determines the destination number of the required controller.



NOTE: The functional architecture is only indicative. The MSC and GMSC may also be collocated and FNT may also be connected directly to the MSC using a PABX.

Figure 2: Functional Architecture

When initiating the call the mobile termination has to provide user-to-user information embedded in its setup message containing the functional number of the calling party. The

network has to transfer this user-to-user information transparently embedded in the setup signalling to the fixed network user terminal, if applicable.

6. CELL SPECIFIC ROUTING

The cell specific routing using short codes is based on the mobile originated call establishment procedure according [6].

In the GSM system there are two parameters, that can be used for destination determination during call setup:

- Called party address (Short Code)
- Cell Identifier

The called party address is provided by the mobile termination to MSC over the air interface, the cell identifier is also provided per call to the MSC by the BSC on the A-Interface.

6.1. Overview of signalling

In this overview the messages required to implement cell specific routing by using short codes are identified. The messages required to implement this feature, namely COMPLETE LAYER 3 INFORMATION [7] and SETUP [6], are printed in bold letters.

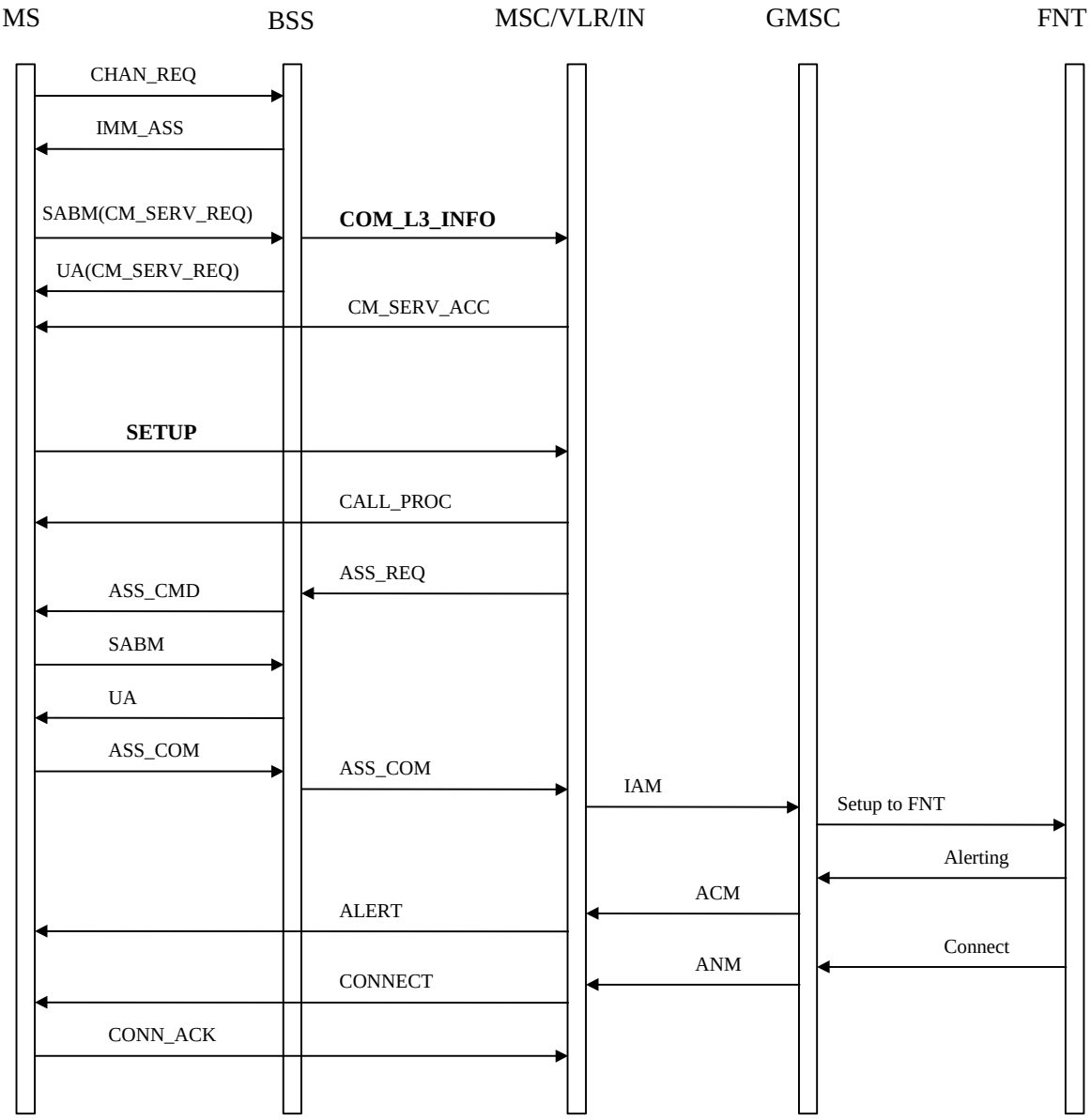


Figure 3

Message Flow for Cell Specific Routing using Short Codes

6.2. Message functional definition

6.2.1. COMPLETE LAYER 3 INFORMATION

The COMPLETE LAYER 3 INFORMATION message contains as mandatory information element the Cell Identifier according [7].
In order to avoid ambiguities in case of different network configurations the usage of the Cell Global Identification (CGI) is recommend.

6.2.2. SETUP (mobile originated call establishment)

The SETUP message is used to provide the functional Short Code to the MSC using the mandatory information element Called Party BCD Number according [6].

6.3. Normal operation with successful outcome

The Cell Identification provided per call to the MSC in the COMPLETE LAYER 3 INFORMATION message identifies the radio cell in a unique way.

The Called party BCD number provided by the mobile termination in the SETUP message represents the Short Code. The only indication to the MSC for the necessity to apply a cell specific routing is the limited length of the Called party BCD number. The Short Code is limited to a length of 4 digits according to the EIRENE numbering plan.

An application associated to the mobile terminal generates the Short Codes. The used Short Code depends, beside the function of the called party, on possibly available location information provided by an external location system.

Based on the information determined about the user of the external network to be called, the GMSC shall setup the call to this user in the normal manner. Alternatively a normal call to a GSM-R subscriber may be established for controllers being GSM-R subscribers.

6.4. Information storage

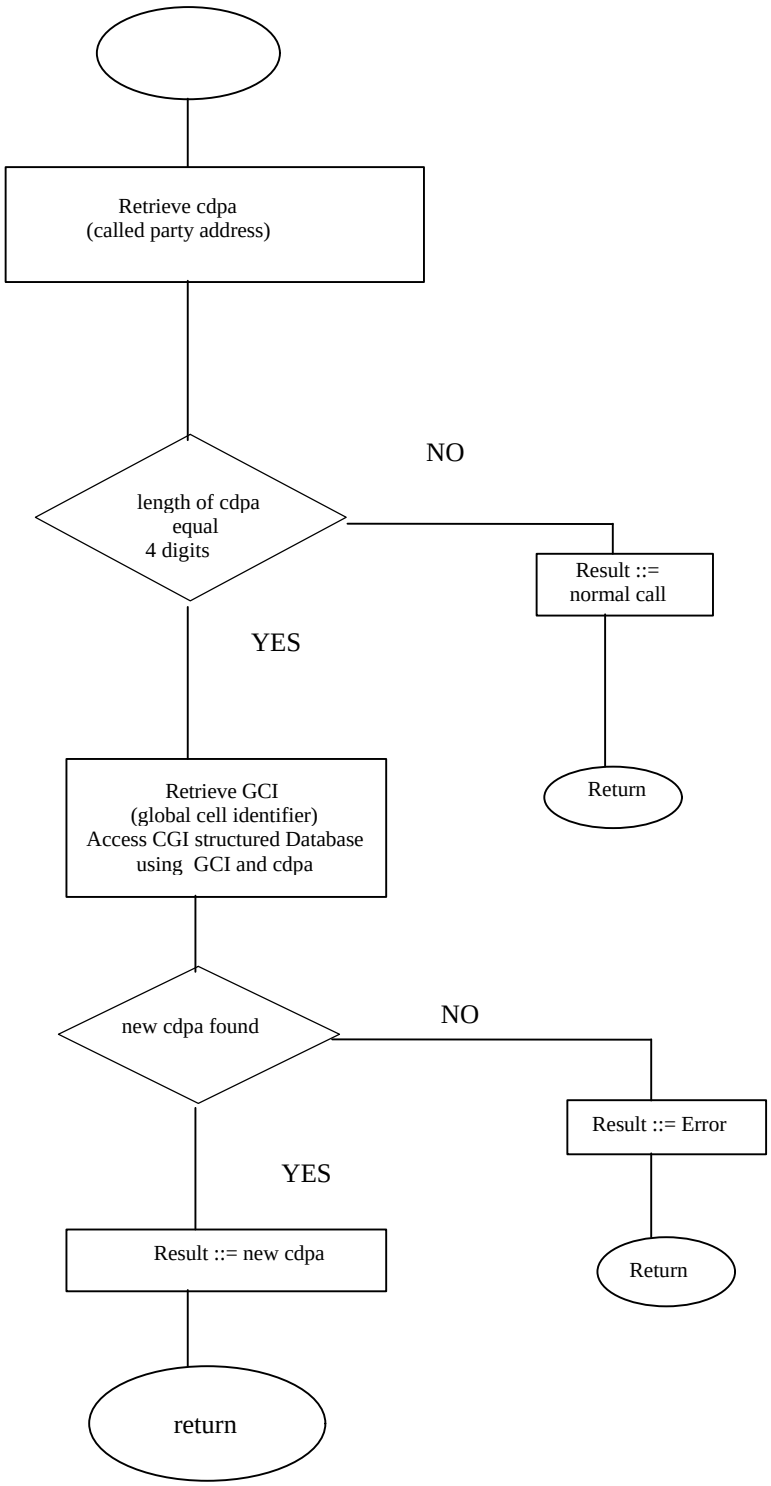
The GSMR network (MSC or IN nodes) has to manage tables in a database to represent the attachment of telephone numbers to radio cells (Cell Identifier (CI)) and functional Short Codes.

The short codes are defined in numbering chapter of document [3].

It should be intended to use cell boundaries as common borders of controller areas for controllers with different functions in order to facilitate the management of the database.

The GSMR network (MSC or IN) database entries may be managed by OMC operations to realise the mapping of Short Codes to telephone numbers.

Macro MSC Addressing



6.5. Exceptional procedures or unsuccessful outcome

If the MSC or IN cannot attach a telephone number to the provided Short Code, the call is released with an appropriate cause value.