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TECHNICAL SPECIFICATION

**Railway Telecommunications (RT);
SMS to Railway numbering plan in roaming environment**

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Railway Telecommunications (RT).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

The operation of GSM-R networks comprises the support of Recommendation ITU-T E.164 [i.2] and the EIRENE numbering plan. Latter one supports the identification of the subscriber based on functional number e.g. train number + functional code. Only E.164 [i.2] numbering plan is applicable for interworking purposes between the GSM-R network and other external telecommunication networks. The MSISDN, derived from Recommendation ITU-T E.164 [i.2] numbering plan, is used to identify the subscriber for routing purposes inside and outside the GSM-R network. To address the subscriber using both numbering plans simultaneously, mapping between the numbering plans is a standard functionality of GSM-R networks.

The simultaneous operation of the numbering plans is applicable to voice, circuit switched data services and short message service. Functional numbers as part of the EIRENE numbering plan can be used simultaneously in different GSM-R networks. To distinguish between them, the international code "IC" is to be prepended to the national functional number.

Short message exchange is a store and forward service provided by a Short Message Service Centre (SMS-SC) which is linked to an E.164 [i.2] numbering plan identity. To enable the SMS exchange based on EIRENE numbering plan, the numbering plan mapping entity needs to be aware about the alignment between the numbering plans on a subscriber basis and if the subscriber is in the own network or abroad.

The case of operator network internal SMS exchange originated by own subscribers is already solved with a proprietary SMS-SC - FFN integration. In the roaming case, a standardized information exchange is needed to align both numbering plans e.g. functional number to MSISDN between the involved GSM-R networks.

1   Scope

The present document describes the message flows and the specific messages to be used between GSM-R networks to enable numbering plan mapping functionality for the exchange of SMS.

In detail:

- Message flows covering the different call types using functional numbers as part of the EIRENE numbering plan.

- Description of USSD Messages to allow the functional number/E.164 [i.2] mapping between the involved GSM-R network entities.

- Description of the SMS address field content to allow presentation of the functional number or E.164 number [i.2] to the terminating party.

Mapping of EIRENE/Recommendation ITU-T E.164 [i.2] numbering plans and the resolution of the functional number that belongs to the subscribers located in the home network is out of scope of the present document.

NOTE: To minimize standardization and implementation effort, all protocols used to exchange the numbering plan mapping information are standard 3GPP/ITU protocols and only specific settings are used for the exchange of the relevant information.

2   References

2.1   Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

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The following referenced documents are necessary for the application of the present document.

[1]   ETSI TS 122 090 (V4.0.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Unstructured Supplementary Service Data (USSD) - Stage 1 (3GPP TS 22.090 version 4.0.0 Release 4)".

[2]   ETSI TS 123 090 (V4.0.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Unstructured Supplementary Service Data (USSD) - Stage 2 (3GPP TS 23.090 version 4.0.0 Release 4)".

[3]   ETSI TS 123 040 (V4.10.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Technical realization of Short Message Service (SMS) (3GPP TS 23.040 version 4.10.0 Release 4)".

[4]   ETSI TS 122 094 (V4.1.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Follow Me Service description; Stage 1 (3GPP TS 22.094 version 4.1.0 Release 4)".

[5]   ETSI TS 123 094 (V4.0.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Follow-Me (FM); Stage 2 (3GPP TS 23.094 version 4.0.0 Release 4)".

[6] ETSI TS 123 078 (10.1.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Customized Applications for Mobile network Enhanced Logic (CAMEL) Phase 4; Stage 2 (3GPP TS 23.078 version 10.1.0 Release 10)".

[7] ETSI TS 129 002 (4.18.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Mobile Application Part (MAP) specification (3GPP TS 29.002 version 4.18.0 Release 4)".

[8] Recommendation ITU-T Q.704: "Signalling network functions and messages".

[9] Recommendation ITU-T Q.712: "Definition and function of Signalling connection control part messages".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] UIC Project EIRENE System Requirements Specification V16.0.

[i.2] Recommendation ITU-T E.164 (11/2010): "The international public telecommunication numbering plan".

[i.3] ETSI TR 123 039 (4.0.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Interface protocols for the connection of Short Message Service Centres (SMSCs) to Short Message Entities (SMEs) (3GPP TR 23.039 version 4.0.0 Release 4)".

3 Definitions and abbreviations

3.1 Definitions

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

call type: prefix (part of EIRENE Numbering plan in EIRENE SRS [i.1]) used to identify the User Number dialled

fixed network: network comprising the fixed terminal system and the dispatcher equipment

fixed terminal subsystem: part of the EIRENE [i.1] system that provides access to this network (and services) via controller equipment (in general referred to as Fixed Terminals)

Follow Me Function Node: register that provides the mapping between the functional number(s) and the MSISDN of the subscriber

functional addressing/numbering: process of addressing a call using a number representing the function a user is performing, rather than a number identifying the user's terminal equipment

functional number: full number used within the functional addressing scheme to contact an end user/system by function or role

location dependent addressing: process of addressing a particular function (typically a controller) based on the current location of the user (typically a train)

short dialling code: dialling code used to trigger the process of location dependent

3.2   Abbreviations

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

CAMEL	Customized Applications for Mobile network Enhanced Logic
CC	Country Code
CGI	Cell Global Identifier
CID	Cell IDentity
CT	Call Type
DN	Destination Number
DP	Detection Point
EIRENE	European Integrated Radio Enhanced Network
FFN	Follow Me function Node
FFN-A	Follow Me Function Node-A
FFN-B	Follow Me Function Node-B
FN	Functional Number
FTS	Fixed Terminal Subsystem
GPS	Global Positioning System
GSM-R	Global System Mobile Railway
HLR	Home Location Register
HLR-A	Home Location Register-A
HLR-B	Home Location Register-B
IC	International Code
IEBOC	International EIRENE BreakOut Code
IMSI	International Mobile Station Identifier
IP	Internet Protocol
ISDN	Integrated Services Digital Network Number
LAC	Location Area Code
LDA	Location Dependent Addressing
MAP	Mobile Application Part
MCC	Mobile Country Code
MNC	Mobile Network Code
MO	Mobile Originated
MS	Mobile Station (user equipment)
MSC	Mobile Switching Centre
MSISDN	Mobile Station Integrated Services Digital Network Number
NDC	National Destination Code
NEN	National EIRENE Number
NI	Network Initiated
NPI	Numbering Plane Indicator
PDU	Packet Data Unit
SC	Service Center
SCCP	Signalling Connection Control Part
SDC	Short Dialling Code
SIM	Subscriber Identity Module
SM	Short Message
SME	Short Message Entities
SMPP	Short Message Peer to Peer
SMS	Short Message Service
SMS-MO	Short Message Service-Mobile Originated
SMS-SC	Short Message Service - Service Centre
SN	Subscriber Number
SRS	System Requirement Specification
TON	Type of Number
UMTS	Universal Mobile Telecommunications System
USSD	Unstructured Supplementary Service Data
VMSC	Visited MSC
VMSC-A	Visited MSC-A
VMSC-B	Visited MSC-B

4   General description

4.1   Requirements

The following requirements shall be fulfilled:

1)   Signalling System No.7 based protocol(s) for information exchange of functional number/MSISDN association.

2)   No need of additional standardization for Mobile Station functionality.

3)   All specified SMS-message classes 0, 1, 2 and 3 shall be supported:

     -    Class 0: This type of SMS message is displayed on the mobile screen without being saved in the message store or on the SIM card; unless explicitly saved by the mobile user.

     -    Class 1: The short message is to be stored in the device memory or the SIM card (depending on memory availability).

4)   Overwrite originator MSISDN by originator Functional Number to present Functional Number.

5)   Provide SMS delivery status report and SMS delivery information.

6)   SMS related information including Calling Functional Number, Called Functional Number, Calling-MSISDN, Called-MSISDN are available for recording purposes (e.g. SMS CDRs).

7)   FTS (e.g. Dispatcher/Controller) is able to originate or receive SMS by using standardized interfaces e.g. IP/SMPP.

8)   There are no restrictions regarding the use of R99 or R4 circuit switched core network environment.

Exception handling:

•   If a SMS is addressed to an EIRENE Functional Number having no MSISDN association, SMS shall be discarded.

•   If a SMS is addressed to an invalid Functional Number, SMS shall be discarded.

•   If the originating subscriber is not registered to a Functional Number, MSISDN of the SMS originator shall be presented to the recipient of the SMS.

Limitation:

•   The present document is only applicable for the use inside the circuit switched core network encompassing 3GPP Release 99 and 3GPP release 4.

•   The present document provides the methodology of the numbering plan transformation while the message content remains unchanged.

4.2   Reference architecture

Functional Number based SMS exchange reuses existing GSM-R network elements and their related functions. Figure 1 illustrates the applicable high level network architecture.

Interworking between GSM-R networks enables subscriber roaming and the exchange of SMS between subscribers.
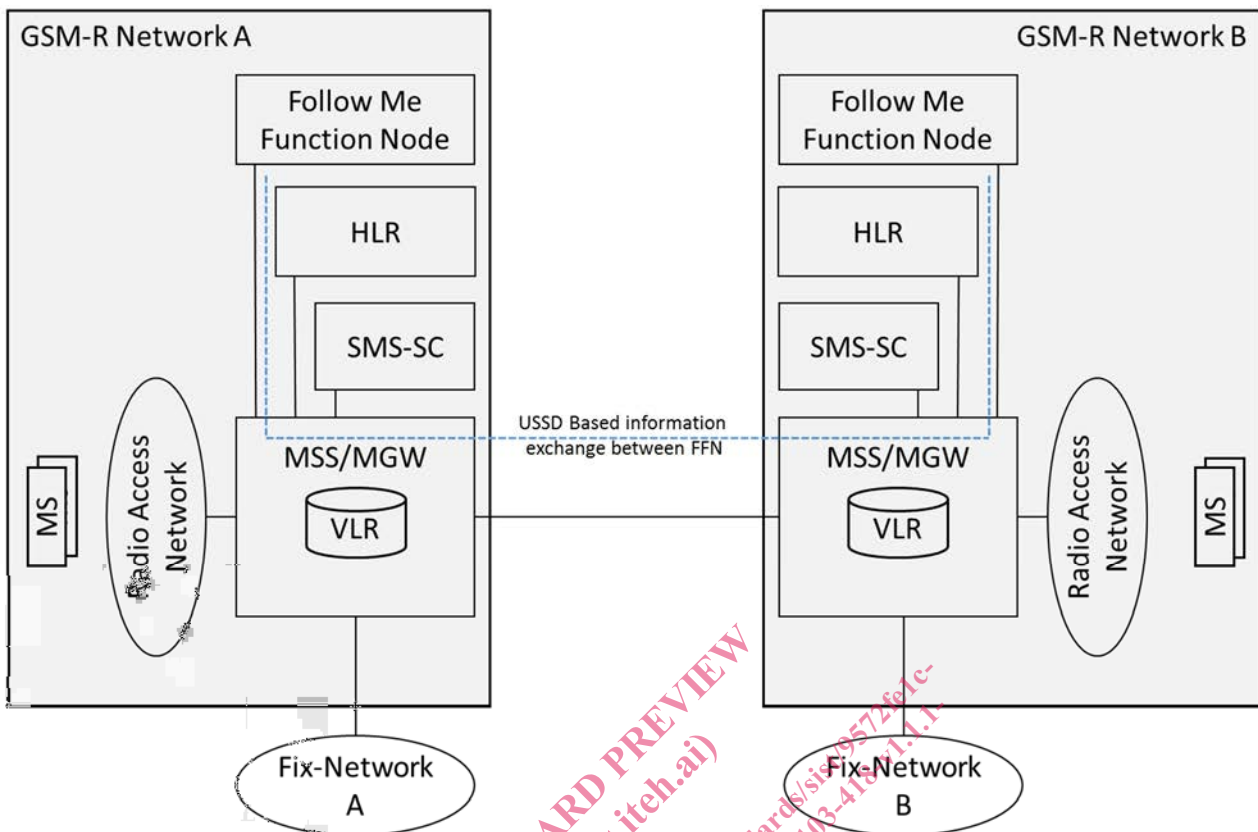
Figure 1: General GSM-R network architecture for Functional Number based SMS interworking

5 Functional concept

5.1 Features and Signalling

The use of EIRENE numbering plan for SMS delivery when abroad refers to several features of existing ETSI specifications. For the relevant features and the necessary signalling information to exchange information between the GSM-R networks, the following specifications shall be applied:

- Unstructured Supplementary Service Data described in ETSI TS 122 090 [1] and ETSI TS 123 090 [2].

- Short Message Service described in ETSI TS 123 040 [3].

- Follow Me Service described in ETSI TS 122 094 [4] and ETSI TS 123 094 [5].

- CAMEL Phase 3 commands: initial DP "MO SMS" and corresponding responses "connect SMS" and "release SMS" described in ETSI TS 123 078 [6].

- Mobile Application Part described in ETSI 129 002 [7].

- Signalling System No. 7 - Message transfer part described in Recommendation ITU-T Q.704 [8].

- Signalling System No. 7 - Signalling connection control part described in Recommendation ITU-T Q.712 [9].

- SMPP for SC to SME interface protocols described in ETSI TR 123 039 [i.3].

5.2 Addressing

Any exchange of short message is based on addressing the target subscriber using the associated MSISDN. The SMS-Service Centre is used to receive the message, store it until the location of the target subscriber has been derived and forward the message. SMS-SC addressing is based on E.164 [i.2] numbering plan, which is used by the subscriber as SMS Service Centre address.

When using functional number to exchange SMS, Recommendation ITU-T E.164 [i.2] SMS-SC address is applicable. To be able to route the SMS towards the recipient, the present functional number shall be resolved into the applicable MSISDN - Recommendation ITU-T E.164 [i.2] number format.

5.3 Location inquiry and routing

Routing and addressing within and between GSM-R Core Networks shall comprise E.164 [i.2] number format. The EIRENE functional numbering scheme is reused in every GSM-R network. To distinct between the functional number(s) and the associated MSISDN, the international code as part of the EIRENE numbering plan shall be always prepended to the functional number.

The SMS processing shall be determined by the functional registration status of the SMS-recipient. Based on the international code as part of EIRENE numbering plan, the processing SMS-SC shall be identified. In case IC is absent, the SMS-SC address of the network the originator is attached shall be used. The visited MSC/MSC-Server shall inquire the applicable SMS-SC E.164 [i.2] address from the FFN of the SMS-originator. If the SMS originator FFN is unaware about the registration status of the SMS recipient, it shall determine the registration status of the SMS recipient by inquiring the recipient FFN. To identify the applicable FFN, the international code of the SMS recipient functional number shall be used. In case IC is absent, the FFN of the network the originator of the SMS is attached shall be interrogated. The FFN response shall contain the association between Recommendation ITU-T E.164 [i.2] and EIRENE numbering plan of the SMS recipient in international numbering format. Based on the SMS recipient network registration status, the SMS shall be forwarded by the visited MSC/MSC-Server to the applicable recipient SMS-SC for further processing.

5.4 Functionality of the SMS-SC

5.4.1 SMS processing from foreign GSM-R subscribers

In order to allow the redirection of SMS to the SMS-SC of the visited network, the SMS-SC of the visited network shall accept mobile originated SMS of roaming subscribers.

   NOTE: To prevent unauthorized usage of the SMS service, an SMS-SC normally only accepts mobile originated SMS of home subscribers.

5.4.2 Enhancements required for presentation of originating FN

The presentation of Functional Number is not intended for SMS. To provide this functionality without modifications of the Mobile/Cab Radio, the field "Origination Address" shall be used to inform about the originating functional number. As a consequence of overwriting, the MSISDN of the originator is not available to the recipient of the SMS. To ensure that SMS originator functional number can be properly used e.g. reply SMS, the following format shall be applied:

- NPI: Recommendation ITU-T E.164 [i.2].

- TON: Unknown.

- Digits: <IEBOC><IC><NEN>.

5.4.3 Delivery report

If required, the delivery report shall be sent back to the originator of the SMS. To present the SMS originator functional number to the recipient of the SMS, the MSISDN of the SMS originator was replaced by the functional number. To route the SMS delivery report, the SMS-SC shall recognize about the initial MSISDN of the SMS originator or shall interrogate the MSISDN of the SMS originator from FFN.