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TECHNICAL SPECIFICATION

**Digital cellular telecommunications system (Phase 2+);
Location Services (LCS);
Broadcast network assistance for Enhanced Observed Time
Difference (E-OTD) and Global Positioning System (GPS)
positioning methods
(3GPP TS 44.035 version 13.0.0 Release 13)**



A GLOBAL INITIATIVE GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS

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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
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Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The present document defines the contents of LCS assistance data broadcast messages from the Serving Mobile Location Centre (SMLC) and the Mobile Station (MS).

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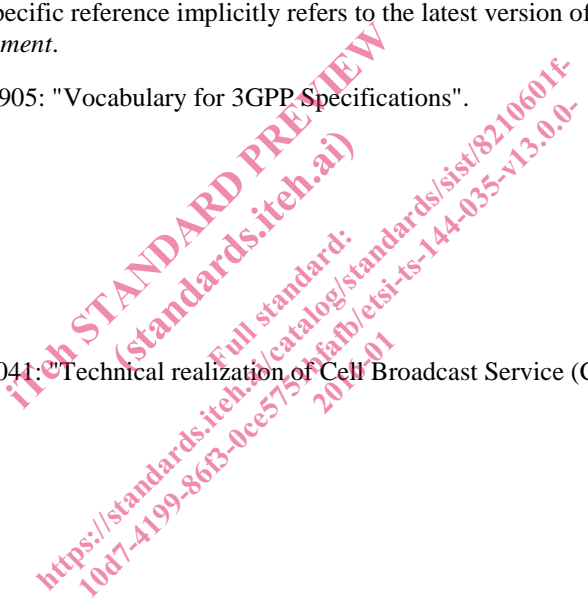
1 Scope

The present document contains the content of messages necessary for support of MS Based location service operation on the mobile radio interface layer 3.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
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- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] Void.
- [3] Void.
- [4] Void.
- [5] Void"
- [6] 3GPP TS 23.041: "Technical realization of Cell Broadcast Service (CBS)".
- [7] Void.
- [8] Void.
- [9] Void.
- [10] Void.
- [11] Void.
- [12] Void.
- [13] Void.
- [14] Void.
- [15] RTCM-SC104: "RTCM Recommended Standards for Differential GNSS Service (v.2.2)".
- [16] ICD-GPS-200: "Navstar GPS Space Segment / Navigation User Interfaces".
- 

3 Definitions and abbreviations

3.1 Definitions

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

E-OTD Assistance Data Message: contains the RTD and BTS coordinates of the neighbours that should be used in E-OTD measurements. This E-OTD Assistance Data is broadcasted using CBCH channel using SMSCB DRX service. The reception of this broadcast message enables MS to calculate its own location.

GPS Assistance Data Message: contains GPS differential corrections. The reception of this broadcast message enables MS to have calculate more accurate location estimate.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 apply.

4 Broadcast Message Contents

This clause describes the LCS Assistance Data messages to be broadcasted in SMSCB message's content part over CBCH channel using SMSCB DRX service. The rules and contents are described so that SMLC is able to construct the message as well as MS is able to process the received message. The E-OTD Assistance Data message contains RTD and BTS coordinate information and GPS Assistance Data contains GPS Differential Correction data, Ephemeris and Clock Correction Data and Almanac and Other Data.

4.1 E-OTD Assistance Data Broadcast Message

The E-OTD Assistance Data message contents are defined in this clause. The E-OTD Assistance Data message is built so that it has always a fixed length and some of the information elements are scalable according to the amount of neighbours and the amount of sectored channels. The information elements are in the order which is described in subclause 4.1.1 and no spare bits are allowed between elements. The MSB bits of the information elements are presented always first and if boundary of the octet divides the information element then the LSB part of the information element continues in the LSB part of the next octet (figure 1). Example of E-OTD Assistance Data Broadcast Message is in annex B. The channel to broadcast the E-OTD Assistance Data message is CBCH over which the SMSCB DRX service is used. One SMSCB message has fixed information data length of 82 octets and the purpose is always to use the whole fixed length message capacity for the message. MS can identify the LCS SMSCB message with E-OTD Message Identifier declared in 3GPP TS 23.041.

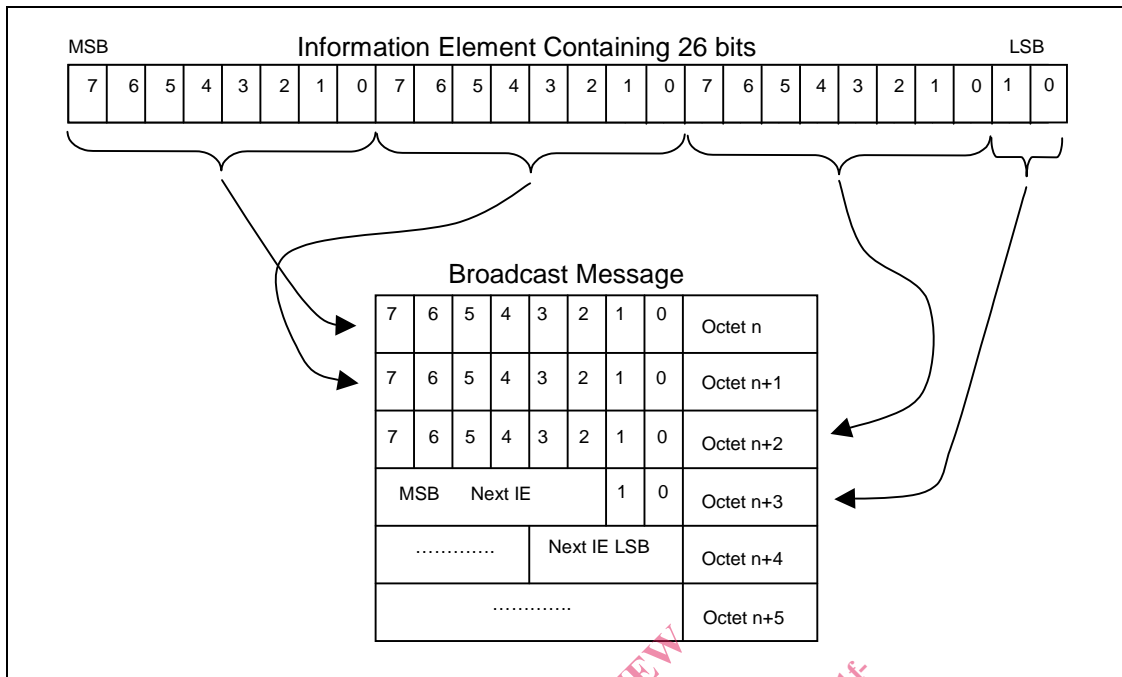


Figure 1: Information element bit mapping to the broadcast message

4.1.1 E-OTD Assistance Data Broadcast Message Content

The Broadcast Assistance Data is a point-to-multipoint message from the GSM Network to the MSs. This message gives assistance data to the MS for performing E-OTD measurements and calculating its own position. It contains the following information elements. The information elements are always in the order described in table 1. The ciphered part of message is end of message and indicated with grey shading in table 1.

Table 1: E-OTD Assistance Data Broadcast Message Content

Information element	Type/Reference	Presence
Message Structure Definition	Message Structure Definition 4.1.1.1	M
Reference Time	Reference Time 4.1.1.2	M
Ciphering Serial Number	Ciphering Serial Number 4.1.1.3	C
Time Slot Scheme	Time Slot Scheme 4.1.1.4	M
Neighbour Bitmap Definition	Neighbour BitmapDefinition 4.1.1.5	C
Sectored Channels Definition	Sectored Channels Definition 4.1.1.6	C
Sectored Channels BTS ID Definition	Sectored Channel's BTS ID Definition 4.1.1.7	C
Sectored BTS Sync/Async Definition	Sectored BTS Sync/Async Definition 4.1.1.8	C
51 Multiframe Offset Values	51 Multiframe Offset Values 4.1.1.9	M
BCC Definition	BCC Definition 4.1.1.10	M
RTD Drift Factor Values	RTD Drift Factor Values 4.1.1.11	C
Channel RTD Values	Channel RTD Values 4.1.1.12	C
Serving Cell Location	Serving Cell Location 4.1.1.13	M
Relative Neighbour Location Values	Relative Neighbour Location Values 4.1.1.14	M

4.1.1.1 Message Structure Definition IE

This IE contains the definition of this broadcast message. The length of this IE is 19 bits and it is mandatory. This IE contains the following bits.

Table 2: Message Structure Definition

Bit	Bit order in field	Definition
1	LSB	Neighbour List Map (bits 2-0)
2		
3		
4	MSB	Accuracy Range (bits 2-0)
5		
6		
7		Ciphering Key Flag
8		Cipher On/Off
9		Sector Ind
10		RTD Range
11	LSB	RTD Accuracy (bits 1-0)
12		
13		RTD Drift Factors Present
14		RTDs Present
15	LSB	Number of Neighbours (bits 4-0)
16		
17		
18		
19	MSB	

The first three octets upto bit 3 in octet 3 in the broadcast message's content part containing the Message Structure Definition IE look always as follows.

8	7	6	5	4	3	2	1
Cipher On/Off	Ciphering Key Flag	Accuracy Range (bits 2-0)		Neighbour List Map (bits 2-0)		Octet1	
Number of Neighbours (bits 4-3)		RTDs Present	RTD Drift Factors Present	RTD Accuracy (bits 1-0)		RTD Range	Sector Ind
(Next IE)				Number of Neighbours (bits 2-0)		Octet3	

The definitions of each structure item is declared below:

Neighbour List Map

These bits define in which order the neighbours in the System Information Neighbour List (max 32 neighbours) are reported with the broadcast message.

- The Neighbour List Map will also affect the amount of bits that can be used for Relative Neighbour Location Value definitions.
- This Broadcast Assistance Data message is always referring to the neighbour BTSs included in the System Information Neighbour List which is received in idle state from BCCH. The E-OTD broadcast message does not allow the possibility for delivering assistance data for other BTSs (outside the the System Information Neighbour List).

Table 3: Neighbour List Map

2	1	0	Definition
0	0	0	All Neighbours from neighbour list
0	0	1	Even Neighbours from neighbour list
0	1	0	Odd Neighbours from neighbour list
0	1	1	1 st & 1 st +n*3
1	0	0	2 nd & 2 nd +n*3
1	0	1	3 rd & 3 rd +n*3
1	1	0	Neighbour Bitmap Definition
1	1	1	Spare

- All Neighbours means all the neighbours from System Information Neighbour list (max 32 neighbours) are reported in this broadcast message (1 broadcast message).
- Even/Odd neighbours from neighbour list means the even/odd list entries in the System Information Neighbour List are reported in this broadcast message (two broadcast messages needed).
- 1st & 1st+n*3 means that 1st, 4th, 7th, 10th, ..., 31st (max 11 neighbours) will be reported in this broadcast message (1/3 of total broadcast).
- 2nd & 2nd+n*3 means that 2nd, 5th, 8th, 11th, ..., 32nd (max 11 neighbours) will be reported in this broadcast message (2/3 of total broadcast).
- 3rd & 3rd+n*3 means that 3rd, 6th, 9th, 12th, ..., 30th (max 10 neighbours) will be reported in this broadcast message (3/3 of total broadcast).
- The 1st & 1st+n*3, 2nd & 2nd+n*3 and 3rd & 3rd+n*3 means total 3 broadcast messages.
- Neighbour Bitmap Definition will define which neighbours are included into this broadcast message, see subclause 4.1.1.5.

Accuracy Range

The accuracy range declares the accuracy of the values in the Relative Neighbour Location Value IE. The accuracy range has the following information.

Table 4: Accuracy Range

2	1	0	Definition
0	0	0	5 km
0	0	1	10 km
0	1	0	15 km
0	1	1	20 km
1	0	0	30 km
1	0	1	45 km
1	1	0	60 km
1	1	1	120 km

For example if there are 15 bits (1 sign bit and 14 value bits) reserved for Relative Neighbour North or East Value and the accuracy range is defined to be 20 km, then resolution of Relative Neighbour North or East Value is 0.6 m.

Ciphering Key Flag

The MS gets two (2) deciphering keys always with location update, a deciphering key that is time stamped to be current one and deciphering key that time stamped to be next one. Thus the MS has always two deciphering keys in memory. With this Ciphering Key Flag in this broadcast message the MS knows whether to use current/next deciphering key for deciphering the received broadcast message. The MS shall interpret this IE as follows:

- **Ciphering Key Flag**(previous message) = **Ciphering Key Flag**(this message) => Deciphering Key not changed.
- **Ciphering Key Flag**(previous message) <> **Cipher Key Flag**(this message) => Deciphering Key changed.

Cipher On/Off

This bit indicates whether this broadcast message has been ciphered or not. The RTD Drift Factor Values IE, Channel RTD Values IE, Serving Cell Location IE and Relative Neighbour Location Values IE will be ciphered if ciphering is active.

- '0' Ciphering Off.
- '1' Ciphering On.

Sector Ind

This bit indicates whether this broadcast message contains BTS Sector Cell information or not.

- '0' No Sector Information included.
- '1' Sector Information included.

RTD Range

This bit indicates whether the RTD value covers only one time slot period or 8 time slot period. This bit will affect the RTD field so that there will be need for 3 bits more for RTD if whole 8 time slot period need to be indicated with RTD value.

- '0' RTD value covers 1 time slot period.
- '1' RTD value covers 8 time slots period.

RTD Accuracy

This contains two bits, which define what will be the accuracy of RTD value in this broadcast message. The accuracy will be coded as follows.

Table 5: Accuracy Range

1	0	Definition
0	0	1/16 bit accuracy
0	1	1/32 bit accuracy
1	0	1/64 bit accuracy
1	1	1/128 bit accuracy

The RTD accuracy will affect the amount of bits needed to indicate the RTD value. The following table describes the accuracy related to needed bits.

Table 6: Amount of RTD bits needed

Time Slots	Accuracy	Amount of Bits Needed
1	1/16	12 bits
	1/32	13 bits
	1/64	14 bits
	1/128	15 bits
8	1/16	15 bits
	1/32	16 bits
	1/64	17 bits
	1/128	18 bits

RTD Drift Factors Present

This bit indicates whether the RTD Drift Factors are present in this broadcast message. If RTDs Present bit indicates that the RTD Values are not included into this broadcast message, the state of this bit should be ignored and the RTD Drift Factors are not present in this broadcast message.

- '0' RTD Drift Factors are not present in the message.
- '1' RTD Drift Factors are present in the message.