ShareTechnote

Home   PartnerCommunity
Email   IEEE Tips / RFC   L
Personal Interest   3GPP Tips   LT

Search   5655

LTE   LTE Adv   5G/NR   2G/3G   LTE - M1   NB-IoT   IoT   IMS/SIP   Throughput   6G
WiFi   SDR   Comm. Tech.   RF   MachineLearning   Embedded Sys   IP/Network   Linux   MechEngneering   Open F
Eng Math   Differential Eq   Matlab   Python   C,C++   Arduino/Raspberry   Android   Java   JavaScript   Electro

4G/LTE - PWS/CBS

CMAS

CMAS stands for Commercial Mobile Alert System. It is equivalent to CBS(Cell Broadcasting Service) in 2G and 3G. At high level view, CMAS, ETWS, CBS belongs to a system called PWS (Public Warning System).

- CMAS Message Structure
- CMAS Message Sequence Example
- Additional Examples of SIB 12 Message
- Decoding / Encoding the warningMessageSegment

CMAS Message Structure

In LTE, there are three main components getting involved in sending CMAS as follows.

    i) Paging : CMAS Notification.
    ii) SIB 12 : Message Format and Contents

Following is Paging, SIB12 showing the field (IEs) related to CMAS. (For the details of ETWS, refer to 3GPP TS23.828 and TS22.268 and TS 36.523 18.1 CMAS on LTE)

```
PCCH-Message ::= SEQUENCE
  +-message ::= CHOICE [c1]
    +-c1 ::= CHOICE [paging]
      +-paging ::= SEQUENCE [0001]
        +-pagingRecordList ::= SEQUENCE OF OPTIONAL:Omit
        +-systemInfoModification ::= ENUMERATED OPTIONAL:Omit
        +-etws-Indication ::= ENUMERATED OPTIONAL:Omit
        +-nonCriticalExtension ::= SEQUENCE [01] OPTIONAL:Exist
          +-lateNonCriticalExtension ::= OCTET STRING OPTIONAL:Omit
          +-nonCriticalExtension ::= SEQUENCE [10] OPTIONAL:Exist
            +-cmas-Indication-r9 ::= ENUMERATED [true] OPTIONAL:Exist
            +-nonCriticalExtension ::= SEQUENCE OPTIONAL:Omit


BCCH-DL-SCH-Message ::= SEQUENCE
  +-message ::= CHOICE [c1]
    +-c1 ::= CHOICE [systemInformation]
      +-systemInformation ::= SEQUENCE
        +-criticalExtensions ::= CHOICE [systemInformation-r8]
          +-systemInformation-r8 ::= SEQUENCE [0]
            +-sib-TypeAndInfo ::= SEQUENCE OF SIZE(1..maxSIB[32]) [1]
            | +- ::= CHOICE [sib12-v920]
            |   +-sib12-v920 ::= SEQUENCE [10]
            |     +-messageIdentifier-r9 ::= BIT STRING SIZE(16) [0001000100010010]
            |     +-serialNumber-r9 ::= BIT STRING SIZE(16) [0011000000000000]
            |     +-warningMessageSegmentType-r9 ::= ENUMERATED [lastSegment]
            |     +-warningMessageSegmentNumber-r9 ::= INTEGER (0..63) [0]
            |     +-warningMessageSegment-r9 ::= OCTET STRING SIZE(ALIGNED)
            |                       [01C576597E2EBBC7F950A8D168341A8D46A3D168341
            |                        A8D46A3D168341A8D46A3D168341A8D46A3D168341A
            |                        8D46A3D168341A8D46A3D168341A8D46A3D168341A8
            |                        D46A3D168341A8D46A3D168341A8D46A3D1000A]
            |     +-dataCodingScheme-r9 ::= OCTET STRING SIZE(1) [01] OPTIONAL:Exist
            |     +-lateNonCriticalExtension ::= OCTET STRING OPTIONAL:Omit
            |     +-EXTENSION ::= SEQUENCE
            +-nonCriticalExtension ::= SEQUENCE OPTIONAL:Omit
```
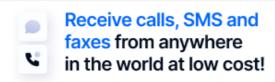
Followings are the description related to warningMessageSegment. (For messageIdentifier, serialNumber, dataCodingScheme, click on the link for the details)
According to 36.331, warningMessageSegmentType, warningMessageSegmentNumber,warningMessageSegment are defined as follows.

warningMessageSegment : Carries a segment of the Warning Message Contents IE defined in TS 36.413-9.2.1.53. The first octet of the Warning Message Contents IE is equivalent to the first octet of the CB data IE defined in and encoded according to TS 23.041 - 9.4.2.2.5 and so on.

< 36.413-9.2.1.53 Warning Message Contents >

Octet Number(s)	Parameter
1	Number-of-Pages
2 – 83	CBS-Message-Information-Page 1
84	CBS-Message-Information-Length 1
...	...
	CBS-Message-Information-Page n
	CBS-Message-Information-Length n
NOTE: n equal to or less than 15	

warningMessageSegmentNumber : Segment number of the ETWS warning message segment contained in the SIB. A segment number of zero corresponds to the first segment, one corresponds to the second segment, and so on.

warningMessageSegmentType : Indicates whether the included ETWS warning message segment is the last segment or not.

CMAS Message Sequence Example

Step	Direction	Message	Comments
1	UE <-- NW	SIB1	Indicate SIB12 is scheduled
2	UE <-- NW	SIB12	Transmit CMAS message
3	UE <-- NW	Paging	CMAS indication is present
4	UE		Detect the Paging with CMAS Indication
5	UE		Decode SIB1 and find SIB12 is scheduled
6	UE		Decode SIB12

According to 36.331-5.3.2.3, the procedure to receiving CMAS is described as follows.

When UE recieved the Paging message,

- Check if the cmas-Indication is included and the UE is CMAS capable:
  - if true, re-acquire SystemInformationBlockType1 immediately, i.e., without waiting until the next system information modification period boundary;
    - Check if the schedulingInfoList in SIB1 indicates that SystemInformationBlockType12 is present:
      - if true, acquire SystemInformationBlockType12;

Step 1 : SIB 1

```
BCCH-DL-SCH-Message
    message: c1 (0)
        c1: systemInformationBlockType1 (1)
            systemInformationBlockType1
                cellAccessRelatedInfo
                    plmn-IdentityList: 1 item
                        Item 0
                            PLMN-IdentityInfo
                                plmn-Identity
                                    mcc: 3 items
                                        Item 0
                                            MCC-MNC-Digit: 0
                                        Item 1
                                            MCC-MNC-Digit: 0
                                        Item 2
                                            MCC-MNC-Digit: 1
                                    mnc: 2 items
                                        Item 0
                                            MCC-MNC-Digit: 0
                                        Item 1
                                            MCC-MNC-Digit: 1
                                cellReservedForOperatorUse: notReserved (1)
                    trackingAreaCode: 0000 [bit length 16, 0000 0000  0000 0000 decimal value 0]
                    cellIdentity: 00000000
                    cellBarred: notBarred (1)
                    intraFreqReselection: notAllowed (1)
                    .... ..0. csg-Indication: False
                cellSelectionInfo
                    q-RxLevMin: -110dBm (-55)
                p-Max: 23dBm
                freqBandIndicator: 4
                schedulingInfoList: 3 items
                    Item 0
                        SchedulingInfo
                            si-Periodicity: rf16 (1)
                            sib-MappingInfo: 0 items
                    Item 1
                        SchedulingInfo
                            si-Periodicity: rf32 (2)
                            sib-MappingInfo: 1 item
                                Item 0
                                    SIB Type: sibType3 (0)
```

```
                        systemInfoValueTag: 0
                        nonCriticalExtension
                            nonCriticalExtension
                                ims-EmergencySupport-r9: true (0)
```

Step 2 : SIB 12

```
BCCH-DL-SCH-Message
    message: c1 (0)
        c1: systemInformation (0)
            systemInformation
                criticalExtensions: systemInformation-r8 (0)
                    systemInformation-r8
                        sib-TypeAndInfo: 1 item
                            Item 0
                                sib-TypeAndInfo item: sib12-v920 (10)
                                    sib12-v920
                                        messageIdentifier-r9: CMAS Identifier for CMAS Presidential Level Alerts (4370)
                                        serialNumber-r9: 3000 [bit length 16, 0011 0000  0000 0000 decimal value 12288]
                                            00.. .... .... .... = Geographical Scope: Display mode immediate, cell wide (0)
                                            ..11 0000 0000 .... = Message Code: 768
                                            .... .... .... 0000 = Update Number: 0
                                        warningMessageSegmentType-r9: lastSegment (1)
                                        warningMessageSegmentNumber-r9: 0
                                        warningMessageSegment-r9: 0154747a0e4acf416137a8d82ecbcf65f7388...
                                        dataCodingScheme-r9: 01
                                            0000 .... = Coding Group: Coding Group 0
                                                        (Language using the GSM 7 bit default alphabet) (0)
                                            .... 0001 = Language: English (1)
```

Step 3 : Paging

```
PCCH-Message
    message: c1 (0)
        c1: paging (0)
            paging
                nonCriticalExtension
                    nonCriticalExtension
                        cmas-Indication-r9: true (0)
                            [Expert Info (Warn/Sequence): Commercial Mobile Alert System Indication!]
                                [Commercial Mobile Alert System Indication!]
                                [Severity level: Warn]
                                [Group: Sequence]
```

NOTE : This paing would not carry specific UE ID since this Paging is broadcasting (i.e, for every UE in the cell)

Additional Examples of SIB 12 Message

Example 01 :

```
BCCH-DL-SCH-Message
    message: c1 (0)
        c1: systemInformation (0)
            systemInformation
                criticalExtensions: systemInformation-r8 (0)
                    systemInformation-r8
                        sib-TypeAndInfo: 1 item
                            Item 0
                                sib-TypeAndInfo item: sib12-v920 (10)
                                    sib12-v920
                                        messageIdentifier-r9:
                                            CMAS Identifier for CMAS Presidential Level Alerts (4370)
                                        serialNumber-r9: 3007
                                            [bit length 16, 0011 0000  0000 0111 decimal value 12295]
                                            00.. .... .... .... = Geographical Scope:
                                                Display mode immediate, cell wide (0)
                                            ..11 0000 0000 .... = Message Code: 768
                                            .... .... .... 0111 = Update Number: 7
                                        warningMessageSegmentType-r9: lastSegment (1)
                                        warningMessageSegmentNumber-r9: 0
                                        warningMessageSegment-r9:
                                            01c576597e2ebbc7f950a8d168341a8d46a3d168341a8d46...
                                            [1 Fragment (84 bytes): #1(84)]
                                                [Frame: 1, payload: 0-83 (84 bytes)]
                                                [Fragment Count: 1]
                                                [Reassembled Length: 84]
                                                [Reassembled Data:
                                                    01c576597e2ebbc7f950a8d168341a8d46a3d168341a8d46...]
                                        dataCodingScheme-r9: 01
                                            0000 .... = Coding Group:
                                             Coding Group 0(Language using the GSM 7 bit default alphabet)(0)
                                            .... 0001 = Language: English (1)

HEX (BCCH) :
00 40 2E 21 11 23 00 78 0A 80 38 AE CB 2F C5 D7 78 FF 2A 15 1A 2D 06 83 51 A8 D4 7A 2D 06 83 51 A8
```

```
=> According to 23.041-9.4.2.2.5 CB Data, the decoded result is as follows
      01 : Number of Page = 1
      0A : Message Information Length = 11
      Contents of the Message : C5 76 59 7E 2E BB C7 F9 50 A8  ==> Emergency!!
```

Decoding / Encoding the warningMessageSegment

The contents of CMAS(warningMessageSegment) is encoded in various different method as described in DCS page. Since there are too many different coding scheme, it would be hard to find a tool that can encode/decode every coding scheme. But if the message uses the two most common coding scheme called GSM 7bit and UCS, you can use the on-line tool called SMS Server Tools 3. As the name implies, this tool is not specifically designed for CMAS. It is designed for encoding / decoding SMS. But the coding scheme for SMS and CMAS is similar, you can use this tool to encode / decode CMAS message.

Here goes short tips on how to use this tool.

Encoding : Text To HEX (GSM 7 bit)

(1) Select '7' at Alphabet Size
(2) type in the text you want to send as CMAS message
(3) press [Convert>] button
(4) the resulting AT command to send this message
(5) the resulting HEX string for the message
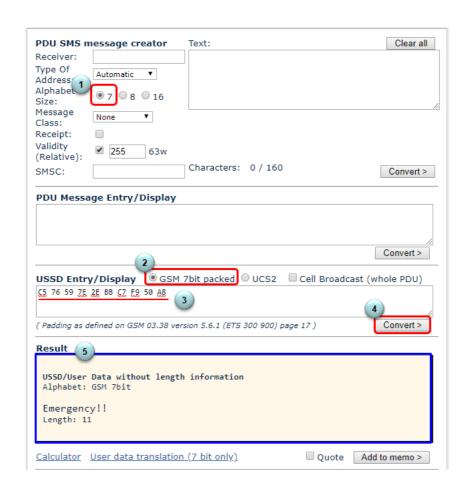

Decoding : HEX (GSM 7 bit) to Text

(1) Select '7' at Alphabet Size
(2) Select 'GSM 7bit packed'
(3) type in HEX string for the text you want to send as CMAS message
(4) press [Convert>] button
(5) the result text

Reference :

[1] Appendix: GSM 7-bit Default Alphabet Table (with Character Codes of ISO 8859 Latin 1)
[2] SMS Server Tools 3

Buy
pho
num
witl
18%

additional se

for free

Get calls, SMS
from any plac

Leade
Alibaba.

Buy a
numb
18% d

additional services

Get calls, SMS and fax
from any place in the

Buy a
numb
18% o

additional services

Get calls, SMS and fax
from any place in the

Buy a
numb
18% o

additional services

Get calls, SMS and fax
from any place in the

Buy
pho
num
with
18%

additional se

Get calls, SMS
from any place

Rec
SMS
from
in th
at lo

Virtual numbe
120 countries
with up to dis

freezvo

See Our
Pricing
Telnyx

See Our
Pricing
Telnyx