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## **16 kHz Charge Event Notification**

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## 0. Document history

Every update of this document results in a complete new version with new version number and release date.

Version	Date	Main or important changes since previous version
1.2	11 JUL 2000	...
1.3	10 FEB 2003	<ul style="list-style-type: none"><li>• § 2.4: note added</li><li>• § 4: applicable switching types adapted</li></ul>

## **1. Definition and scope**

The 16 kHz charge notification is an optional supplementary service on analog PSTN lines.

This document describes the charge related events as observed at the user to network interface for an analog PSTN line.

The descriptions hereunder must be considered as being part of a physical layer protocol definition. The use of these events by the PSTN network services (application layer) and the semantic relation between these events and the service billing functions are subject to some basic rules stated in this document; the exact relationship with billing is out of scope of this specification.

Each charge event has a fixed amount of money related to it called "Value of charge unit" (VOCU). Depending on the PSTN services, the event can be used by the customer as a cashing event (revenue perspective), or as an indication of the charge (cost perspective).

## 2. Charge event notification scenarios

### 2.1. Functional behaviour

Two main scenarios can be expected at the user to network interface:

#### 2.1.1. no charge events are sent to the user line

- a) in case of charge free services
- b) in case of particular new Value Added Services, because the charging cannot be determined in the exchange on which the subscriber line is connected
- c) when the charge event information is not offered or not generated by the operator (e.g. in case of use of a carrier selection code to go to another operator)

#### 2.1.2. charge events scenario :

In principle, this scenario is used for all the services that will appear on the customer's bill. When the charge information is available the following sequence is generated :

- events of type "charge\_event\_at\_answer", generated at the moment of the called party answer.
- events of type "charge\_event\_during\_call", generated during the conversation phase.

2.2. Message Sequence Chart for charge event notification

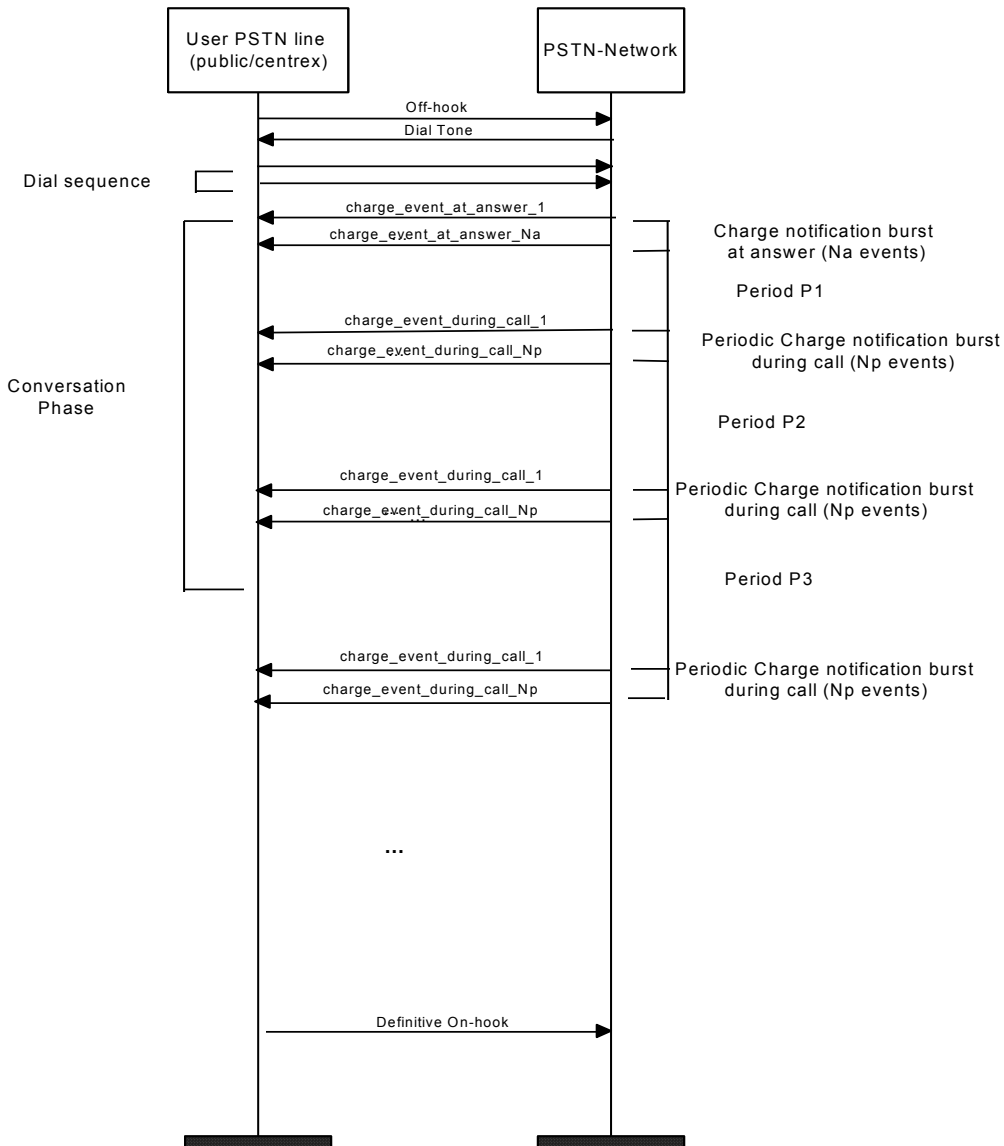


Figure 1 - Message Sequence Chart for charge event notification

The User PSTN line of the figure is the controlling party of the call. Charge events are only sent at the calling side. We define the conversation phase the period that both parties are hooked off after answering. The User PSTN line will continue to receive charge events also after the conversation phase between the clear back period (the hook on of the called party) and the re-answer timer expiration in case the calling side has not hooked on.

### 2.3. Event notification time behaviour

Event notification occurs periodically according to a temporal pattern also known as “non-linear periodic pulse metering” (NL-PPM). Non-linear indicates that the interval of time between two consecutive pulses is not always constant, but reflects as good as possible the real time based billing. The temporal pattern distinguishes :

- a. charge event bursts characterized by:
  - a number N of events rapidly sent one after another
  - an intra burst period ( $> = 0.2$  sec and  $< = 0.5$  sec). With intra burst period the period between the start of two consecutive of the N pulses is meant.
- b. inter burst periods  $P_i$  (  $i = a, b$  or  $c$  )

The metering pattern is defined in terms of total number of events generated as a function of the call duration (NLPPM (duration) ). The function depends on a set of 7 parameters (see 2.3.1.2) called *Tariff*. The function is fully defined when each parameter has a value assigned to it.

#### 2.3.1. Definition of Non-linear periodic pulse metering

##### 2.3.1.1. Variables:

$T(Event)$  : time at which Event is observed/sent by the Network.

$d = T(Definitive\ release\ communication\ path\ between\ calling\ called) - T(Answer)$  : call duration

##### 2.3.1.2. Parameters :

$P_a, P_b, P_c$  : inter burst time periods

$N_a, N_p$  : integral number of burst events

$M_a, M_b$  : integral number of periods

A *Tariff* is a particular set of all the parameters

2.3.2. Function:

NLPPM (d) : call cost/revenue function on Charge Unit scale. (See Figure 2)

NLPPM (d) =

$N_a$	for $0 \leq d < P_a$
$NLPPM(d - P_a) + N_p$	for $P_a \leq d < M_a * P_a$
$NLPPM((M_a - 1) * P_a) + N_p$	for $M_a * P_a \leq d < M_a * P_a + P_b$
$NLPPM(d - P_b) + N_p$	for $M_a * P_a + P_b \leq d < M_a * P_a + M_b * P_b$
$NLPPM(M_a * P_a + (M_b - 1) * P_b) + N_p$	for $M_a * P_a + M_b * P_b \leq d < M_a * P_a + M_b * P_b + P_c$
$NLPPM(d - P_c) + N_p$	for $M_a * P_a + M_b * P_b + P_c \leq d$

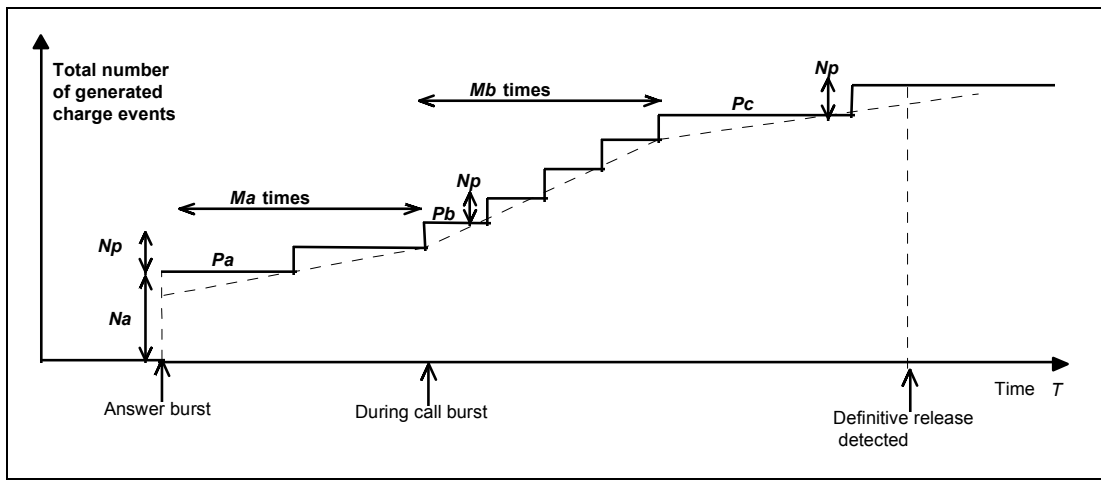


Figure 2 - NL-PPM metering model

- When the called party answers the call, a burst of  $N_a$  charge events are generated towards the calling party line and the NL-PPM metering is started.  $N_a$  accounts for the answer and for the first period  $P_a$ . The first period  $P_a$  may be slightly less than the nominal value of  $P_a$  due to implementation reasons.
- If  $M_a > 1$ , at the end of the first period  $P_a$ , a new period  $P_a$  is started. At the beginning of each new period  $P_a$ , a burst of  $N_p$  charge events are generated towards the calling party line and accounts for the current period  $P_a$ .
- At the end of  $M_a$  periods  $P_a$ , a new period  $P_b$  is started, possibly different from  $P_a$ . At the beginning of each period  $P_b$  (including the first one), a burst of  $N_p$  charge events are generated towards the calling party line and accounts for the current period  $P_b$ .
- At the end of  $M_b$  periods  $P_b$ , a new period  $P_c$  is started, possibly different from  $P_b$ . At the beginning of each period  $P_c$  (including the first one), a burst of  $N_p$  charge events are generated towards the calling party line and accounts for the current period  $P_c$ . This period is used for the remainder of the call.
- $N_p$  has the same value throughout the call.

## 2.4. Application

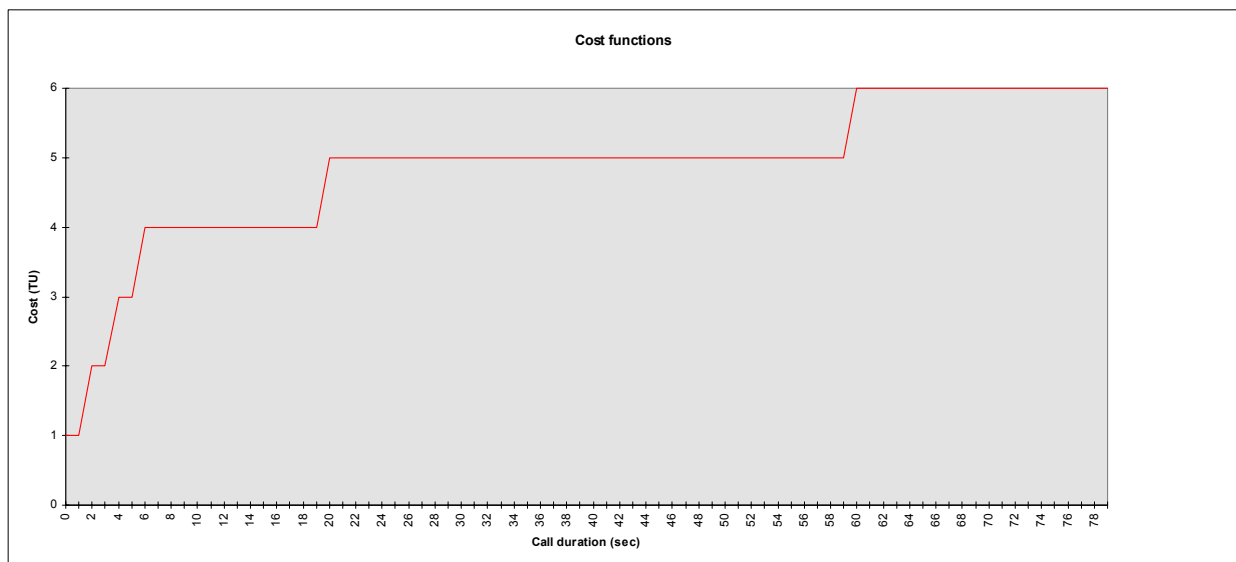
During the conversation phase of a call, different NL-PPM metering patterns can follow each other corresponding to different Tariffs.

Only the tariff periods Pa, Pb or Pc may change during the lifetime of the call, according to the applied tariff regime. The values Ma, Mb are not affected by a tariff change.

If a tariff change occurs the current tariff period continues to its normal end and the subsequent tariff period will take the new value.

### Example :

Na	1
Np	1
Ma	3
Pa	2 sec
Mb	1
Pb	14 sec
Pc	40 sec



**Figure 3 - Example of NL-PPM**

### Note:

The pattern of higher mentioned example (Figure 3) and the NL-PPM metering model (Figure 2) is valid for one single call initiated by the user, subscribed to homemeter.

Suppose the user has set up both legs of a 3PTY call: in this case two (possibly) different tariff patterns will run in parallel and send pulses to the user, independently each one from another. As a result, the overall pattern will differ from the given model.

2.4.1. Limitations :

- the values for Na and Np are limited to 4 possible combinations
- the values for Na are in the range from 1 to 31 Charge events
- the values for Np are in the range from 1 to 10 Charge events
- the values for Ma, Mb are in the range from 1 to 127
- the value of the first tariff period Pa is included in the range from 90% to 100% of the nominal value of tariff period Pa
- the minimum value of tariff period Pa, Pb and Pc are limited to 400 ms.
- the maximum value of tariff period Pa, Pb and Pc are limited to 1800 s.
- the incremental step of the tariff period Pa, Pb and Pc are limited to

<u>range tariff period</u>				<u>incremental step</u>	
				<u>tariff period</u>	
0.4 s	=<	Pi	<	30 s	0.1 s
30 s	=<	Pi	<	600 s	1 s
600 s	=<	Pi	<	1800 s	10 s

For each range, all values starting from the lower range value and incremented by the incremental step to the higher range value, must be possible for the tariff period Pa, Pb and Pc.

- the accuracy of internal clock(s) is limited to 1% less or more of the nominal value of the applicable incremental step.

### 3. Mapping on physical layer

Each charge notification event is presented to the user's PSTN line as a 16 kHz pulse.

#### 3.1. Principle

When a calling line has the category 'Homemeter', the exchange will send on the line a 16 kHz pulse for each charge pulse (only for calls with speech phase).

#### 3.2. Frequency

Nominal: 16 kHz  
Tolerance:  $\pm 0.5\%$   
Harmonic distortion: max 5 %

#### 3.3. Level

Nominal: 2.6 V rms on 200 Ohm  
Tolerance:  $\pm 0.4$  V rms

#### 3.4. Pulse duration

Nominal: 150 ms  
Tolerance:  $\pm 30$  ms

#### 3.5. Maximum cadence

Maximum: 2.5 pulses per second

#### 3.6. Parasitic signals

The total power of the parasitic signals (harmonics included) created by the generator must be 26 dB lower than the power of the 16 kHz wave.

#### **4. Availability**

The 16 kHz charging event notification function is available as an option on analogue lines of following switches of the Belgacom network (with the limitations as specified in 2.4.1):

- Alcatel switches S12 Pack 7 / Pack 8
- Siemens switches EWSD V14B / V16B