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**Transmission and interface  
characteristics of PSTN service**

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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                     |
|---------|-------------|--|
| 2.0     | 28 APR 1999 | ...  |
| 2.1     | 26 FEB 2001 | <ul style="list-style-type: none"><li>• 2.1 Adding example</li></ul> |

## **1. Introduction**

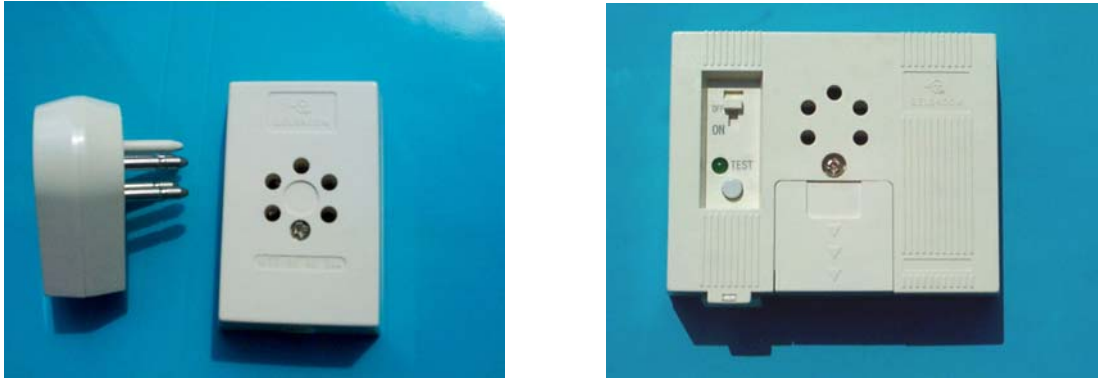
The PSTN service is offered to the customer via an interface on the Network Termination Point (NTP). Although the NTP can be installed in the customer's building in various ways (e.g. with electronic network equipment, by means of a simple connection box, etc.), the physical and electrical characteristics of the PSTN interface offered to the customer will be clearly described below.

Paragraph 3 also defines the main transmission qualities specific to PSTN service.

## 2. PSTN interface characteristics

### 2.1. Mechanical characteristics of the PSTN interface

- The standard interface offered to a PSTN customer consists of a four-prong connector terminating a two-wire telephone circuit (+ one ground wire). This connector is described in Chapter 8 of ETSI specifications ETS 300 001 (dated January 1997). As an example, two photos of a PSTN interface realisation are shown in figure 2.1.



*figure 2.1*

- In addition, Belgacom currently also offers the following interfaces:
  - \* an RJ11 connector;
  - \* a connection block for making hardwired connections.

### 2.2. Electrical characteristics of the PSTN interface

- *Power supply for the PSTN interface*
  - \* The PSTN interface is supplied by direct voltage from the Belgacom network. The power supply used for this purpose is described in the specification User Network Interface "Analog Subscriber Line Signalling (Basic Call)" with reference BGC\_D\_48\_9807\_30\_02\_E.DOC.
- *Transmission Impedance*

The nominal impedance for 800 Hz is fixed at 600 Ohm.
- *Ringling current*

The exchange generates a ringing current as described in the specification User Network Interface "Analog Subscriber Line Signalling (Basic Call)" with reference BGC\_D\_48\_9807\_30\_02\_E.DOC.

### 3. Transmission characteristics

- This paragraph describes the end-to-end transmission characteristics of the PSTN service, independent of the physical transmission medium used.

In spite of the fact that in most cases the connection between a PSTN customer and the public automated exchange is established by means of one or more cable sections (*the characteristics of this cable are described in Appendix A*), a significant number of customers in the local network are already connected to the telephone exchange via a pair gain system or, partially, via special equipment (e.g. optical fiber).

- End-to-end transmission characteristics of the Belgacom PSTN network are at a minimum compliant with ITU-T recommendation G.120. Additional information on a number of these parameters is supplied below:

- \* Attenuation distortion

This distortion is a result of the fact that attenuation varies depending on frequency. Attenuation distortion is expressed in dB and in relation to the attenuation of a reference signal at 800 or 1,000 Hz.

Attenuation distortion complies at a minimum with ITU-T recommendations G.132 and G.151.

- \* Passband

The bandwidth actually made available to the customer is between 300 Hz and 3,400 Hz.

- \* Loudness rating

The specifications relating to loudness rating of a national and/or international PSTN connection comply with the specifications of ITU-T recommendations G.111 and G.121, respectively.

- \* Group-delay distortion

Group-delay distortion is compliant with the specifications defined in ITU-T recommendation G.133.

- \* Transmission delay

The average one-way transmission time of a national and/or international PSTN connection complies with the specifications defined in ITU-T recommendation G.114.

- \* Stability

As far as communication stability is concerned, the PSTN connection is in compliance with the specifications of ITU-T recommendation G.122.

- \* Noise

As far as noise is concerned, the PSTN network complies with ITU-T recommendation G.123.

- If the customer is linked to the Belgacom telephone exchange by means of a simple twisted pair, the transmission characteristics at two-wire analog interfaces of digital Belgacom exchanges comply with ITU-T recommendation Q.552.

#### 4. References

|                                     |  |
|-------------------------------------|--|
| <i>ETS 300 001 (1997):</i>          | Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN. |
| <i>ITU-T recommendation G.111:</i>  | Loudness ratings in an international connection.   |
| <i>ITU-T recommendation G.114:</i>  | Mean one-way propagation time.   |
| <i>ITU-T recommendation G.120:</i>  | Transmission characteristics of national networks.   |
| <i>ITU-T recommendation G.121:</i>  | Loudness ratings of national systems.  |
| <i>ITU-T recommendation G.122:</i>  | Influence of national systems on stability, talker echo, and listener echo in international connections.   |
| <i>ITU-T recommendation G.123:</i>  | Circuit noise in national networks.  |
| <i>ITU-T recommendation G.132:</i>  | Attenuation distortion.  |
| <i>ITU-T recommendation G.133:</i>  | Group-delay distortion.  |
| <i>ITU-T recommendation G.151:</i>  | General performance objectives applicable to all modern international circuits and national circuits.  |
| <i>ITU-T recommendation Q.552 :</i> | Transmission characteristics at 2-wire analogue interfaces of digital exchanges.   |
| <i>BGC_D_48_9807_30_02_E.DOC</i>    | Analog Subscriber Line Signalling (Basic Call)   |

## Appendix A: characteristics of local network cables

A telecoms cable consists of a number of *cores* surrounded by a layer of insulating material. The cores of such a cable are always grouped in *pairs of conductors*.

Cables in the local network are designed so as to ensure optimum transmission and guarantee minimum mechanical resistance. For this reason, the description of cables below consists of a section dealing with electrical characteristics and one dealing with mechanical characteristics.

### *Mechanical characteristics*

- The conductors of a local cable are round, full wires consisting of 98%–99% pure electrolytic copper.
- A conductor is isolated by a layer of synthetic material (usually polyethylene).
- Most conductors have a 0.5 mm or 0.6 mm diameter with a maximum negative variance of 0.01 mm and a positive variance of 0.03 mm.
- The set of conductors is covered by a waterproof extruded cable sheath (usually polyethylene). Under normal circumstances, the cable is also longitudinally waterproof.
- The cable cores are arranged in a specific manner. The two conductors (e.g. of a telephone circuit) must be arranged symmetrically in relation to all other conductors. For this reason, conductors are twisted and placed in coaxial cylindrical layers (*a basic unit consists, for example, of four conductors twisted around one another and from which two telephone circuits can be created; a cross section shows that these four conductors form the corners of a square. The conductors located on two opposite angular points form a pair*).

### *Electrical characteristics*

- Since the signals to be transmitted are changeable electrical voltages, the cable conductor must be a good transmission medium for electrical signals. The important elements are defined for a unit length of one kilometer and are called primary electrical parameters of a conductor. These parameters are kilometer resistance R, kilometer inductance L, kilometer capacity C and kilometer leakage G.
  - ◆ kilometer resistance R
    - \* Kilometer resistance is the initial resistance of a one kilometer conductor pair that is looped at the remote end; the value of this parameter is therefore the resistance of a conductor with a length of two kilometers.
      - ⇒ R is 180 Ohm for a conductor diameter of 0.5 mm (at 20°C);
      - ⇒ R is 123 Ohm for a conductor diameter of 0.6 mm (at 20°C).
    - \* It should be noted that due to the skin effect, the alternating current resistance is higher than the direct current resistance indicated above.
  - ◆ kilometer inductance L
    - \* In a symmetrical pair cable, conductors forming a pair lie very close to one another; kilometer inductance L is therefore very low (approx. 0.5 mH per kilometer).
  - ◆ kilometer capacity C
    - \* The capacity between two conductors of the same pair can be measured when the rest of the cable conductors are connected to each other and to an equipotential point of a measuring device. The nominal value of kilometer capacity C is situated between 38.5 nF/km and 50 nF/km at 800 Hz.

◆ kilometer leakance G

- \* Kilometer leakance G depends on the frequency concerned and kilometer capacity C. Theoretically, kilometer leakance may be considered as negligible.
- \* G can roughly be calculated with the help of the following formula, in which k has a value between 0.005 and 0.02 ( $\omega$  = pulsation in rad/s):

$$G = k \cdot \omega \cdot C$$

- The insulation resistance of each conductor in relation to the rest of the conductors (and any shielding) is at least 5 G $\Omega$ /km.