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Specification of physical and electrical characteristics at the 2-wire analogue presented NTP on the Telenet network.

Telenet

Reference

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Keywords

Analogue, interface, PSTN

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Contents

1 Scope

The present document specifies the physical and electrical characteristics at the analogue presented Network Termination Point (NTP) intended to deliver 3,1kHz voiceband services which terminates a Public Switched Telephone Network (PSTN) with short to medium length 2-wire local loop. The terminal equipment (TE) shall be connected to the Local Exchange (LE) through the HFC access network. This means that a transmission path between the LE and the TE over the access network needs to exist before any voice transmission can be established.

The PSTN was designed for voice traffic. However, it is possible to carry other analogue signals, though no guarantees are given or implied as to the effect of the PSTN on these signals. Digital data may be sent over the PSTN using suitable analogue modulation equipment (modems).
Because data transmission performance is subject to many uncontrollable variables, Telenet cannot guarantee data rates over the PSTN.

The electrical conditions specified at the NTP are sufficient to ensure satisfactory operation of the following functions of TE:

a) call control;
b) transmission;
c) dialling;
d) ringing.

Older type of interfaces are not covered in this document because of the impending upgrade of these interfaces.

This document is based on ETSI EG 201 188 [1] V1.1.1 (1999-06).

2 References

[1] ETSI EG 201 188 V1.1.1 (1999-06)
"Public Switched Telephone network (PSTN); Network Termination Point (NTP) analogue interface; Specification of physical and electrical characteristics at a 2-wire analogue presented NTP for short to medium length loop applications."

[2] Miniature 6-position plug as described in FCC 47, CFR 68.500:
"Code of Federal Regulations (USA); Title 47 Telecommunication; Chapter 1 Federal Communications Commission, Part 68 Connection of Terminal Equipment to the Telephone Network; Subpart F Connectors; Section 68.500 Specification".

[3] ETSI Technical Standard ETS 300 001, January 1997, fourth edition:
"Attachment to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

[4] ETSI TBR 21 :
"Terminal Equipment (TE); Attachment requirements for pan-European approval for connection to analogue Public Switched Telephone Networks (PSTNs) of TE (excluding TE supporting the voice telephony service) in which network addressing, if provided, is by means of Dual Tone Multi Frequency (DTMF) signalling".

[5] ETSI TBR 38 :
"Public Switched Telephone Network (PSTN); Attachment requirements for a terminal equipment incorporating an analogue handset function capable of supporting the justified case service when connected to the analogue interface of the PSTN in Europe"

[6] ETSI EG 201 120 :
"Public Switched Telephone Network (PSTN); Method of rating terminal equipment so that it can be connected in series and/or parallel to a Network Termination Point (NTP)"

[7] ITU-T Recommendation Q.552 (1996) :
"Transmission Characteristics at 2-wire analogue interfaces of digital exchanges".

[8] ITU-T Recommendation G.117 (1990):
"Transmission aspects of unbalance about earth (definitions and methods)".

[9] ITU-T Recommendation G.711 (1988) :
"Pulse code modulation (PCM) of voice frequencies".

[10] ITU-T Recommendation G.712 (11/96) :
"Transmission performance characteristics of pulse code modulation channels".

[11] ETSI ETR 206 :
"Public Switched Telephone Network (PSTN); Multi Frequency signalling system to be used for push-button telephones [CEPT Recommendation T/CS 46-02 E (1985)]".

[12] ETSI ETR 207 :
"Public Switched Telephone Network (PSTN); Alternative sender for multifrequency signalling system to be used for push-button telephones"

[13] ETSI TR 101 183 :
"Public Switched Telephone Network (PSTN); Analogue ringing signals"

[14] Telenet document : TS-102 :
"Information tones on the Telenet PSTN interface"

3 Definitions, symbols and abbreviations

3.1 Definitions

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

Answer signal Indication that a terminal is answering an incoming call

Called party answer signal Signal which may be provided at the call originating NTP by the network to indicate that the called party has answered the call

Clear indication Indication that the network is attempting to release a connection

Clear signal Signal indicating that a terminal is attempting to release a connection

End-of-call signal Signal provided at the NTP by the network to indicate that the call has been released

Network Termination Point(NTP) Physical point at boundery of the PSTN intended to accept the connection of a TE

Ringing state Condition of the network where a ringing/alerting signal has been applied at the NTP

Ring trip Removal of the ringing signal at the NTP in response to a valid answer signal applied to the NTP

Seize signal Signal indicating that a terminal is attempting to establish a connection by means of applying a loop condition

3.2 Symbols

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

dBV the absolute voltage level expressed as dB relative to 1 V
dBm0 the absolute power level in dBm referred to a point of zero relative level
dBr the relative level of a signal in a transmission path referred to the level at a reference point on the path

3.3 Abbreviations

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

AGC Automatic Gain Control
ALASS Analogue Local Access Signalling Services
DTMF Dual Tone Multi Frequency
HFC Hybrid Fiber Coax
IDP Inter-digital pause
LD Loop Disconnect
LE Local Exchange
LF Loading Factor
LU Loading Unit
NTP Network Termination Point
ONU Optical node unit
PSTN Public Switched Telephone Network
REN Ringer Equivalence Number
RLR Receiving Loudness Rating
SDH Synchronous Digital Hierarchy
SLR Sending Loudness Rating
TE Terminal Equipment

4 General description of the Telenet HFC network

The network is of the Hybrid Fibre Coax (HFC) type. A schematic of the network is given in Figure 1.

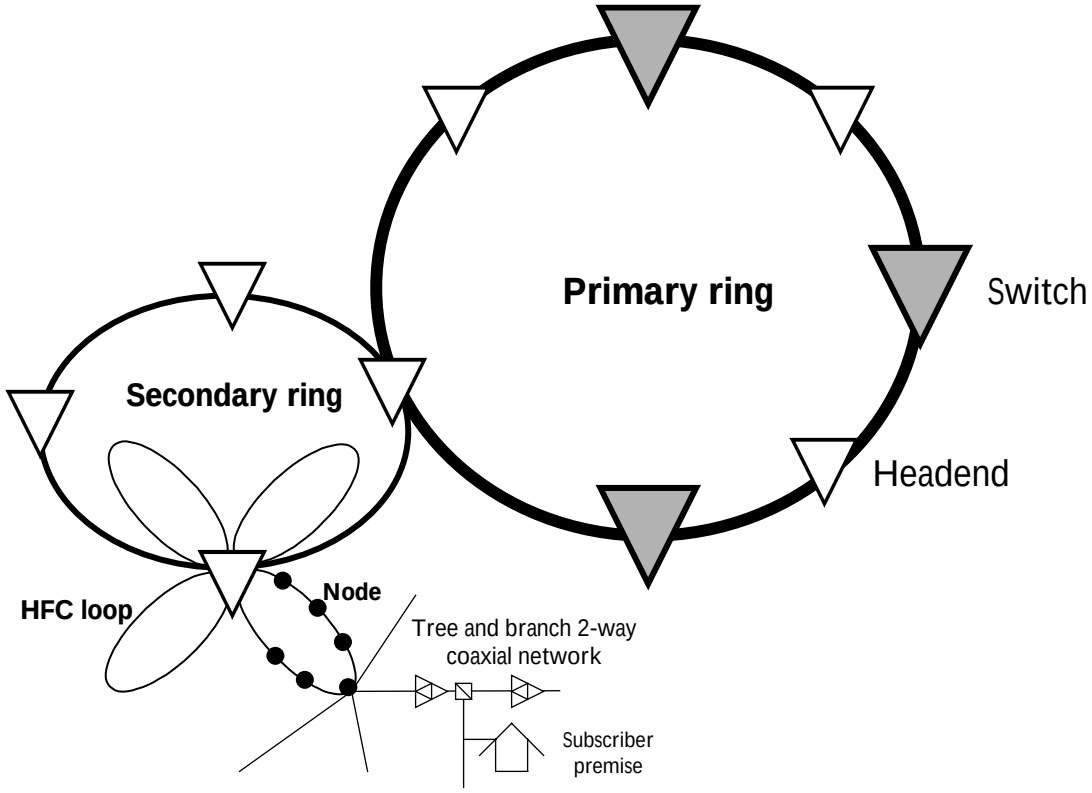

Figure 1

The network consists of a primary ring, on which the switches are located. A number of headends are also directly connected to the primary ring. Apart from the primary ring, a number of secundary rings exist. These rings are linked to the primary ring at a headend location. One secundary ring connects a number of headends. From each headend a number of HFC loops originate. A number of optical nodes are located on these loops.
From the switch to the optical node unit (ONU) the transmission path consists of optical fibre. Transport between switches is governed by SDH, while the link between a headend and a switch consists of a V5.2 interface. Signals are fed from the headend to the ONU by an optical fibre link. In the ONU, signals are converted from the optical to the electrical domain for the downstream direction and vice versa for the upstream direction. The electrical signals are transported to and from the subscriber over a bidirectional tree and branch coax plant. An RF cable modem is located at the subscriber's premises. The upstream and downstream RF frequencies are listed in Table 1. The protocol between a headend and the cable modem at the subscriber's premises is a proprietary protocol.

Upstream	15 MHz to 25 MHz
Downstream	40 MHz in the 300 MHz – 470 MHz band

Table 1 : Upstream and downstream RF frequencies bands

The cable modem will present one or more PSTN interfaces depending on the model.

Physical Connections

5.1 Mechanical Aspects

The physical presentation of the NTP is presented as a socket capable of connecting with a miniature 6-position plug as specified in FCC 47, CFR 68.500 [2] clause (a) with contact assignments as specified in table 2.
This connector type is often referred to as RJ 11.

Contact number	Pin allocation
1	Operator reserved function
2	Operator reserved function
3 / 4	Pair (A- and B-wire)
5	Operator reserved function
6	Operator reserved function

Table 2 : Connector contact assignments.

5.2 Support of more than one terminal

5.2.1 Wiring arrangement

The NTP will support :

- Type 1, Type 2, Type 3 (I), Type 3 (II), or Type 4 terminals (ETS 300 001 [3] January 1997, Chapter 1, Section 1.4.4.1) connected in series or parallel configurations as long as the summed loading affects do not exceed the following:
  The maximum number of terminals on a single A-B termination is limited by the sum of Terminal Ringing Loading Factor and the minimum current each terminal typically requires in the "on line" (off hook) state.

- Typically, four TBR21 [4] compliant terminals can be supported in the "off line" ringing state and two TBR 21 compliant terminals can be supported in the simultaneous "on line" state without performance degradation.

Additional terminal loading or terminals that require excessive Ringing LF or current in the "on line" state will cause performance degradations of all the terminals that are common on a single A-B termination.

Excessive terminal load will not cause any damage at the NTP.

5.2.2 Loading Factors

The maximum number of terminals that can be supported at the NTP is defined in terms of a Loading Factor (LF), as defined in EG 201 120 [6].
The NTP supports up to a LF = 228 LU max (limited by the ringing load impedance).

6. D.C. feed conditions

6.1 Polarity

The B-wire is negative with respect to the A-wire.
Depending on the type of cable modem, one wire is grounded to earth.

6.2 Quiescent state

6.2.1 Maximum voltage

The maximum open circuit d.c. voltage presented between the A- and B- wires of the NTP is 52 V.

6.2.2 Minimum voltage

When a resistor with a value of 100/LF MOhm, where LF is the stated LF arising from subclause 5.2.2, is connected between the A- and B- wires of the NTP, the continuous d.c. voltage appearing at the NTP is minimum 38 V.
As suggested in the EG 201 188 [1], it is the intention to reduce this value in future designs to 21V. Therefore it is strongly recommended to test the terminal equipment assuming that a minimum d.c. voltage of 21V is available in quiescent state.

6.3 Loop current

6.3.1 Loop current range

When a resistor with a value in the range 0 to 500 Ohm is connected between the A- and B- wires at the NTP, there will flow a d.c. current in the range of 40 mA to 50 mA.

6.3.2 Loop current interruptions caused by the terminal

Brief loop current interruptions of less than 20 ms between the A- and B- wires will not cause any change of condition at the NTP.

7. Seize signal

7.1 Must not seize condition

When a resistor with a value such as to cause a loop current not greater than 3 mA d.c. to flow is connected at the A and B- wires of the NTP, it will not be recognized by the network as a seize signal.

The network will not recognize a seize condition when the loop current changes from quiescent to a loop current greater than 10 mA for a period of less than 10 ms.

7.2 Must seize condition

When a resistor with a value such as to cause a loop current not less than 10 mA d.c. to flow is connected for a period of greater than 20 ms at the A- and B- wires of the NTP, it will be correctly accepted by the network as a seize signal.

The NTP will provide a minimum of 4mA into a 1kOhm load until transitioning into the full loop current state.

8 Clear signal

8.1 Clear signal generated by TE

The clear signal threshold current is defined more than 2 mA lower than the seize signal threshold current.

The NTP will detect a loop current of less than or equal to 6 mA as a line clear (Loop Break) signal.
A clear signal (Loop Break) of more than 400 ms is accepted as a clear signal and releases the loop condition at the NTP.

8.2 Clear indication from the network

A connection will be cleared by the network :

a) as a result of calling party TE providing a clear signal to the network; or

b) as a result of either the calling party or the called party TE providing a clear signal to the network; or

c) at the instigation of the network itself, independently of the state of the calling party or the called party.

A PSTN end-of-call signal will be applied at the NTP when the connection is cleared. This will be given as a release tone as specified in 13. Supervisory signals.

8.3 Seizing the line for a new call

When the cable modem has recognized the call clear signal from the TE and after the network cleared the call, the NTP will immediately respond to a new line seizure condition within the timing and loop current limits and conditions noted above.

9 Impedance

9.1 NTP impedance

Depending on the type of cable modem the transmission impedance at 800Hz is 600 Ohm.

9.2 Balance about earth

The balance about earth per CCITT Recommendation G.117 [8], measured as Longitudinal Conversion Loss, is > 40 dB over the frequency range 50Hz to 3400 Hz.

10 Transmission

The NTP adopts the fictitious point and the referenced digital level of A-law PCM, 0 dBr.

10.1 Loss plan

Loss plan : -3 dB (from terminal equipment to NTP) and a -9 dB (from NTP to terminal equipment)

10.2 Frequency response

The NTP complies with the ITU-T Recommendation Q.552 [7] (11/96).

10.3 Coding law

The NTP provides 64 kbps PCM, A-law coding according to ITU-T Recommendation G.711 [9].

10.4 Noise

Noise Output Connection < - 67 dBmp
Noise Input Connection < - 65 dBm0p

ITU-T Recommendation G.712 [10] (11/96) (cross referenced by Q.552) Transmission performance characteristics of pulse code modulation channels Digital to 2W Analog path budgeted to - 70 dBm0p
Table 7, Note 5: Below - 5 dBr, noise limit is - 75 dBmp

10.5 Input levels

Variation of gain with input level complies with ITU-T Q.552 [7] (11/96) 3.1.1.4 Figure 4.

Signal to Total Distortion referenced to a 1020 Hz tone, psophometrically weighted, complies with ITU-T Q.552 [7] (11/96) 3.3.3 Figure 14.

Note: ITU-T Q.552 [7] 3.1.1.4 tests up to a +3dBm0 level.

10.6 Stability

The design of equipment is in line with ITU-T Recommendation Q.552 [7] and the NTP interface is compliant to ITU-T V5.2 standards for digital interface.

10.7 Crosstalk

The crosstalk within the voice bandwith complies with ITU-T Recommendation Q.552 [7] (11/96).
Near end crosstalk < -73 dBm0
Far end crosstalk < -70 dBm0

11 Dialling

The NTP only supports DTMF dialling.

11.1 Signal codes and frequencies

The sixteen combinations assigned to digits or special signalling characters are shown in the matrix below.

		High group frequencies			
		1209 Hz	1336 Hz	1477 Hz	1633 Hz
Low group frequencies	697 Hz	1	2	3	A
	770 Hz	4	5	6	B
	852 Hz	7	8	9	C
	941 Hz	*	0	#	D

11.2 Frequency deviation

Accepted signals in the range of +/- 1,5 %.
Rejected signals out the range of +/- 3,5 %.

11.3 Sending levels

The sending level should be in the range of –4 to –20 dBm/freq. The power level difference between frequencies may maximum be 4dB.

11.4 Signal timing

The signal duration should be minimum 40 ms for correct detection of the signal. Signals shorter then 23 ms will not be detected. The interdigit gap must be minimum 40 ms and the minimum cycle time should be 93 ms/digit.

12 Ringing

12.1 Ringing drive capability

- Ringing Frequency of 25 Hz ± 2 Hz
- Ringing Crest Factor 1,2 ≤ CF ≤ 1,6
- Ringing Harmonic Distortion:
  ≤ 774 mV (psophometric weighting)
- Waveform-shape: Sinusoidal
- Max. AC voltage (open circuit) : 85 VRMS
- Max. ringer load : 1732 Ω + 32 µF (4 REN), LF= 228 LU
- Ringing AC Voltage (min.) at the end of the max loop length when terminated with 1732 Ω + 32 µF (4 REN) load (LF = 228 LU) : 40 VRMS

2 Different types of ring signals can occur at the NTP :

- An a.c.-ringing signal which isn't superimposed on a d.c. voltage (0 VDC offset), but the d.c. voltage is present during the off (silent) parts of the ring cadence.
- A superimposed ringing signal on the off-line d.c. voltage.

12.2 Ring cadence

The default ringing cadence is 1 s on and 3 s off as defined in TR 101 183 [13].

12.3 Ring trip

Any ringing signal presented at the NTP will be removed within 200 ms of an answer signal consisting of a d.c. condition as defined in clause 7 being applied to the NTP.

13 Supervisory signals

The available tones are described in the Telenet document TS-102, Information tones on the Telenet PSTN interface [14].

14 Optional functions

14.1 Loop Disconnect dialling

Telenet only guarantee DTMF dialling.

14.2 Register recall

The network will recognize breaks in the loop current with the range 50 ms to 340 ms applied at the NTP as a registered recall signal.

14.3 Metering

Metering pulses are currently not supported.

14.4 ALASS services

For the support of ALASS services to the TE, the network will provide the NTP with a single burst of ringing current without polarity reversal.

14.5 Polarity reversal

Polarity reversal is currently not supported.

14.6 End of call signal ("K-break")

The "K-break" message set is currently not supported.

14.7 Payphones

Currently no metering pulses are send and no ‘far end’ ‘on line’ indications are given. Therefore only payphones that offer a ‘push-to-talk’ button feature can be supported.

History

Document history		
Version	**Date**	**Milestone**
1	04/04/2000	First released edition
2p1	09/06/2000	Limited adaptations after internal tests
2	15/06/2000	Released edition