PT TELEKOMUNIKASI INDONESIA Tbk.

TELECOMMUNICATION SPESIFICATION
V.90 MODEM TERMINAL

Document number : **STEL D-003 -2000**
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Issued by:
KANTOR PERUSAHAAN PT TELEKOMUNIKASI INDONESIA
DIVISI RISET TEKNOLOGI INFORMASI
Jl. Geger Kalong Hilir No. 47 BANDUNG, 40152
Tel. + 62 22 4574784 (45 RISTI)
Fax + 62 22 214669

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On behalf of DIRECTOR OF PLANNING AND TECHNOLOGY
HEAD OF RisTI

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SURYATIN SETIAWAN
NIK. 542381

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1 GENERAL

1.1 Scope

This specification comprises description, classification, abbreviation, technical term and requirement of V.90 Data Modem terminal.

1.2 Description

V.90 data modem a digital modem and analogue modem pair for use on the Public Switched Telephone Network (PSTN) at data signaling rates of up to 56 000 bit/s downstream and up to 33 600 bit/s upstream. Operation of this modem use duplex mode of operation on the PSTN and adaptive techniques that enable the modems to achieve close to the maximum data signalling rates the channel can support on each connection.

1.3 Classification

V.90 Data modem terminal divided into two major part:

1. Analogue modem:
   The analogue modem is the modem of the pair that, when in data mode, generates V.34 signals and receives G.711 signals that have been passed through a G.711 decoder. The modem is typically connected to a PSTN.

2. Digital modem:
   The digital modem is the modem of the pair that, when in data mode, generates G.711 signals and receives V.34 signals that have been passed through a G.711 encoder. The modem is connected to a digital switched network through a digital interface, e.g. a Basic Rate Access (BRA) or a Primary Rate Access (PRA).

1.4 Abbreviation

Abbreviation	Explanation
AC	Alternating Current
BRA	Basic Rate Access
DBm	Deci Bell mili
DB	deci Bell
DCE	Data Communication Equipment
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
GPA	Generating Polynomial Answer
GPC	Generating Polynomial Call
Hz	Hertz
IEC	International Electro-technical Commission

ISO	International Standard Organisation
ITU-T	International Telecommunication Union-Telecommunication
mA	Mili Ampere
ms	Milli second
PCM	Pulse Code Modulation
PRA	Primary Rate Access
PSTN	Public Switched telephone Network
RxD	Received Data
TxD	Transmitted Data
VAC	Volt Alternating Current
VDC	Volt Direct Current

1.5 Network Configuration

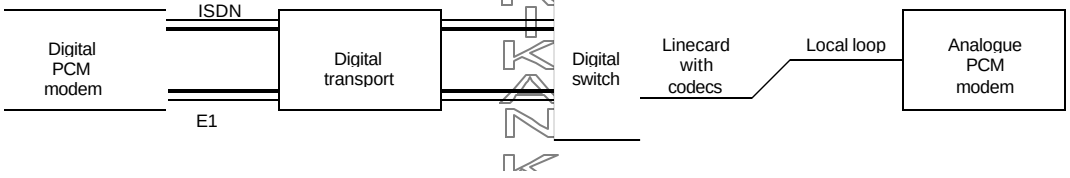

Figure 1. Example Network Configuration

2 REQUIREMENT

2.1 General Operation

2.1.1 Power Supply

a. AC power supply unit has to be able to use the general valid power portion in Indonesia (nominal 220 VAC, frequency 50 Hz)
b. DC power supply unit has to be able to use 48 VDC nominal, 20 mA at any polarity.
c. For V.90 PC card modem, power supply depend on PC power supply requirement.

2.1.2 Transmit Level

Analog Modem should have transmit power level of -13 dBm to -4 dBm.

2.1.3 Indicator

It has to have an indicator for normal operation and alarm operation condition and at least able to form indication as:

a. Transmitted data (TxD)
b. Received data (RxD)
c. Data channel received line detector (Signal)

2.1.4 Environment

Equipment must normally operated in condition below:

a. Temperature 5^0 C – 35^0 C.
b. Humidity 50 % - 95 %

2.1.5 Label

Modem data equipment has to be given a label:

- Brand.
- Type (model)
- Series number
- Agent or manufacture or both of them.

3 SIGNALING REQUIREMENT

3.1 Digital Modem

3.1.1 Data signaling rates

Digital modem shall support synchronous channel data signaling rates from 28 000 bit/s to 56 000 bit/s.

3.1.2 Symbol rate

Digital modem shall support the upstream symbol rates 3000 and 3200 also 3429 (optional). The downstream symbol rate shall be 8000 established by timing from the digital network interface.

3.1.3 Scrambler

The digital modem shall include a self-synchronizing using the generating polynomial, GPC as below:

Call mode modem generating polynomial: (GPC) = $1 + x^{-18} + x^{-23}$
or
Answer mode modem generating polynomial: (GPA) = $1 + x^{-5} + x^{-23}$

3.2 Analog Modem

The characteristics of the analogue modem described herein apply when in V.90 mode. After fallback to V.34 mode, the analogue modem shall have characteristics as defined in Recommendation V.34.

3.2.1 Data signaling rates

The analog modem shall support synchronous data signaling rates in increments of 2400 bit/s of:

- 4800 bit/s to 28 800 bit/s (mandatory)
- 31 200 bit/s and 33 600 bit/s (optional).

3.2.2 Symbol rates

The analogue modem shall support the symbol rate 3200. It may also support 3000 and the optional symbol rate 3429.

Symbol rate, S	a	c
2400	1	1
2743	8	7
2800	7	6
3000	5	4
3200	4	3
3429	10	7

Table 1. Symbol Rate

3.2.3 Carrier frequencies

The analogue modem shall support the carrier frequencies for the appropriate symbol rate as table below, where the carrier frequency shall be (d/e) · S Hz, d and e are integers:

Low carrier				High carrier		
Symbol rate, S	**Frequency**	**d**	**e**	**Frequency**	**d**	**e**
2400	1600	2	3	1800	3	4
2743	1646	3	5	1829	2	3
2800	1680	3	5	1867	2	3
3000	1800	3	5	2000	2	3
3200	1829	4	7	1920	3	5
3429	1959	4	7	1959	4	7

Table 2. Carrier Frequency versus symbol rate

3.2.4 Scrambler

The analog modem should have a self-synchronizing scrambler included for the primary channel data. Auxiliary channel data is not scrambled. Each transmission direction uses a different scrambler, with the generating polynomial:

Call mode modem generating polynomial:
(GPC) = $1 + x^{-18} + x^{-23}$
or:
Answer mode modem generating polynomial:
(GPA) = $1 + x^{-5} + x^{-23}$

3.2.5 Framing

The analog modem should have duration of a super frame is 280 ms.

3.3 Interchange Circuit

3.3.1 List of Interchange Circuit

Refer to ITU-T recommendation V.34 for functional equivalent circuit as describe in table 3 below:

Interchange circuit		
No.	**Description**	**Notes**
102	Signal ground or common return	
103	Transmitted data	
104	Received data	
105	Request to send	
106	Ready for sending	
107	Data set ready	
108/1 or	Connect data set to line	
108/2	Data terminal ready	
109	Data channel received line signal detector	1
125	Calling indicator	
133	Ready for receiving	2

Table 3. Interchange circuit

NOTE 1 – Thresholds and response times are not applicable because a line signal detector cannot be expected to distinguish received signals from talker echoes.

NOTE 2 – Operation of circuit 133 *Use of circuit 133 – Ready for receiving*
The DTE not-ready condition is indicated by turning OFF circuit 133, and is cleared by turning circuit 133 ON.
This method should be the preferred one as it is unambiguous and is applicable to any kind of data communication. It may be assumed that most DCEs recognize with only a short delay the changed condition on circuit 133, and will act accordingly. The remaining buffer size in the DTE may therefore be kept small.
This method is not applicable for half-duplex protocols because circuit 105 will not be available at the DCE. The DCE will always operate in the constant carrier mode.

NOTE 3 – In many publications, circuit 133 (Ready for receiving) is, incorrectly, referred to as circuit 105 (Request to send). These two interchange circuits are significantly different in their respective definitions and functions. The source for confusion may be that, due to a lack of free poles on the interface connectors standardized in ISO/IEC 2110 and ISO/IEC 11569, both interchange circuits are allocated to the same pole (i.e. pole 4) of these connectors.

3.3.2 Asynchronous character mode interfacing

The modem may include asynchronous to synchronous interfacing and may imply data compression.

3.4 Electrical and Functional Requirement

3.4.1 Compatibility

Terminal could be connected correctly to PSTN and other terminal within the same standard.

3.4.2 Outgoing call

Analogue terminal should generate DTMF signaling for outgoing call with characteristic below:

Nominal Frequency (Hz)		Higher Frequency		
		1209	1336	1477
Lower Frequency	697	1	2	3
	770	4	5	6
	852	7	8	9
	941	*	0	#

Table 4. DTMF Table

a. Power/Level
Power/Level DTMF not less than -11 dBm and not exceed -4 dBm.

b. Group Level
Higher Frequency group level should be greater than lower frequncy group level by 2 ± 1.5 dB.

c. Signal length and spacing
Signal length (tone-on) 40~500 mili second and spacing between signal (tone-off) 40~500 mili second to send sequential bits.

3.4.3 Receive Level

Analogue terminal should receive voice level –33 dBm.

3.4.4 Return Loss

Analogue terminal should have return loss ≥ 12 dB for (300~600) Hz and ≥15 dB for (600~3400) Hz measured with resistive impedance 600 Ohm, -10 dBm.

3.5 Interfaces

Digital terminal should provide:

a. E1 interface comply with TELKOM's specification STEL T-022-1999.

b. PRA interface comply with TELKOM's specification STEL Q-030-1996.

REFERENCE

1. ITU_T V.90 1998 A digital modem and analogue modem pair for use on the Public Switched Telephone Network (PSTN) at data signalling rates of up to 56 000 bit/s downstream and up to 33 600 bit/s upstream
2. ITU-T V.34 1998 A modem operating at data signalling rates of up to 33 600 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits
3. ITU-T V.24 1998 List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)
4. ITU-T V.8 1998 Procedures for starting sessions of data transmission over the public switched telephone network