

PETRONAS TECHNICAL STANDARDS

MANUAL

TELECOMMUNICATIONS STANDARDS

PTS 32.71.00.11

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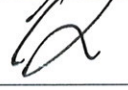
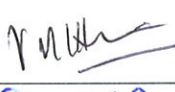
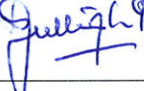
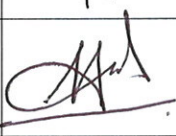
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This revision of PTS **32.71.00.11 – Telecommunications Standards** has been updated incorporating PETRONAS Lessons Learnt, Best Practice and new information issued by relevant industry code and standards.

The previous version of this PTS (**May 2004**) will be removed from PTS binder/e-repository from herein onwards.

Document Approval

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PREFACE

PETRONAS Technical Standards (PTS) publications reflect the views, at the time of publication, of PETRONAS OPU/Divisions.

They are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PETRONAS' OPU/Divisions in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where PTS may not cover every requirement or diversity of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use PTS they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, it is expected of them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the owner.

The right to use PTS rests with three categories of users:

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1. INTRODUCTION

1.1 SCOPE

This PTS specifies requirements and gives recommendations for private telecommunication networks and public telecommunication network services. International telecommunication standards are set by agreement through the auspices of the International Telecommunication Union (ITU), a specialised agency of the United Nations dealing with telecommunications. These standards are published by the ITU and take the form of Regulations, Recommendations, Resolutions, Reports and Final Acts.

This is a revision of an earlier PTS with the same title and number, dated May 2004. A summary of the primary changes from the previous edition is listed in (1.6).

National telecommunication standards are based on ITU recommendations but may contain significant variations. Some ITU recommendations specially allow for local or regional interpretation. Private networks should follow ITU recommendations as far as possible to gain cost advantage by purchasing standard equipment and to allow interworking with other equipment and networks, especially the public telecommunication network. Public Telecommunication Operators (PTOs) may insist on adherence to local variations and special interface standards. Care should be taken to verify applicable local standards for connection.

The International Telecommunication Union, via its Consultative Committees, adopts standards according to the principle of consensus. As a result of this process, the titles of standards are sometimes more a result of the political process rather than a specific reference to its contents. This could hamper the practical value of this PTS and **for this reason, some titles have been slightly modified to provide better guidance to their content.** However, all standards are listed in logical order, and with their actual titles, in (6). Because of a re-organisation within the ITU, new standards will be issued by the Telecommunications Standards Division (ITU-T) and radio frequency spectrum matters by the Radiocommunication Division (ITU-R).

ITU standards are issued in an electronic format and the previous method of coloured books with volume numbers is no longer in use. Therefore, ITU standards are all referred to in this PTS by means of the series letter and number, not a book volume.

Some miscellaneous standards also apply, for instance those of the International Electrotechnical Commission (IEC). These standards are mentioned within the paragraphs concerned.

The provision of aeronautical and maritime communication and navigational aids for offshore platforms and small private airfields is often part of the responsibility of the telecommunication organisations. For this reason, the main standards of the International Maritime Organisation (IMO) and the International Civil Aviation Organisation are included in this PTS, although detailed discussion of these standards is outside the scope of this document.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by PETRONAS, the distribution of this PTS is confined to companies forming part of PETRONAS.

This PTS is intended for use in oil refineries, gas plants, chemical plants, oil and gas production facilities, and supply/marketing installations. When PTS are applied, a Management of Change (MOC) process should be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this PTS, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this PTS which is considered to be necessary in order to comply with national and/or local

regulations. The Principal may then negotiate with the Authorities concerned with the object of obtaining agreement to follow this PTS as closely as possible.

1.3 DEFINITIONS

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project, or operation or maintenance of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.4 ABBREVIATIONS

ADPCM	Adaptive Differential Digital Pulse Code Modulation
ARQ	Automatic Repeat Request
Async	Asynchronous
ATM	Asynchronous Transfer Mode
BER	Bit Error Ratio
Bps	Bits per second
CCIR	International Radio Consultative Committee
CELP	Code enhanced linear predictive
CS-ACELP	Conjugate Structure Algebraic CELP
DASS II	Digital Access Signalling System No 2
DCE	Data Circuit-terminating Equipment
DTE	Data Terminal Equipment
DPNSS	Digital Private Network Signalling System
EIA	Electronic Industries Association
EMC	Electro Magnetic Compatibility
ESD	Electro Static Discharge
FDDI	Fibre Distributed Data Interface
FDM	Frequency Division Multiplex
FM	Frequency Modulation
GAT	Group Audio Terminal (Audio conference system)
IDN	Integrated Digital Network
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ITU	International Telecommunication Union
ITU-R	International Telecommunication Union Radiocommunications division
ITU-T	International Telecommunication Union Telecommunications division
LAN	Local Area Network
MTBF	Mean Time Between Failure
NDB	Non Directional Beacon
NGN	Next Generation Network
NOTAM	A notice containing aeronautical information to personnel concerned with flight operations
PABX	Private Automatic Branch Exchange
PAD	Packet Assembler/Disassembler
PCM	Pulse Code Modulation
PDH	Plesiochronous Digital Hierarchy
PDS	Premises Distribution System
PTO	Public Telecommunication Operator

SDH	Synchronous Digital Hierarchy
SHF	Super High Frequency
SOLAS	Safety Of Life At Sea
TDMA	Time Division Multiple Access
UHF	Ultra High Frequency
VHF	Very High Frequency
VSAT	Very Small Aperture Terminal
WARC	World Administrative Radio Conference

1.5 CROSS-REFERENCES

Where cross-references to other parts of this PTS are made, the referenced section number is shown in brackets. Other documents referenced by this PTS are listed in (6).

2. INTERNATIONAL STANDARDS FOR TELECOMMUNICATIONS

2.1 GENERAL CHARACTERISTICS OF CARRIERS

2.1.1 General

Privately operated networks have been set up throughout the world because PTOs are often unable to extend their services to remote locations. ITU-T recognises private networks and gives guidance on the general standards to follow when private networks are connected to the public networks.

The International Telecommunications Union (ITU), a specialised agency under United Nations, is responsible for the harmonisation on the global use of the spectrum. The structure of Malaysia's Spectrum Plan under the jurisdiction of Malaysian Communications and Multimedia Commission (MCMC) is based on the ITU Standards and Regulations.

2.1.2 Digital carriers

Digital technology has now effectively replaced analogue carrier systems, and the ITU-T standards applying to digital carriers cover either the 1544 kbps or 2048 kbps hierarchy, otherwise known as T1 or E1. The decision as to which hierarchy to follow will be influenced by the existing local public network hierarchy and the availability of equipment and installation/maintenance support.

Main ITU-T standards:

- G.175 Transmission planning for private/public network interconnection of voice traffic.
- G.702 Digital hierarchy bit rates
- G.703 Characteristics of digital interfaces
- G.704 Synchronous frame structures used at 1544, 2048, 6312, 8448 and 44,736 kbps hierarchical levels
- G.732 Characteristics of primary PCM multiplex equipment operating at 2048 kbps
- G.733 Characteristics of primary PCM multiplex equipment operating at 1544 kbps
- G.741 to 747 Characteristics of second order multiplex equipment
- G.751 to 755 Characteristics of higher order multiplex equipment.
- G.803 Architecture of transport networks based on the Synchronous Digital Hierarchy (SDH)
- G.804 ATM cell mapping into Plesiochronous Digital Hierarchy (PDH)

2.2 TRANSMISSION MEDIA

2.2.1 Cables

In general, cables should be:

- copper-based symmetrical pairs for office and small campus size, with distances up to 90 m;
- coaxial and fibre-optic cable for high bandwidth applications;
- fibre-optic cable, particularly for distances greater than 90 m.

Selection should be based on capacity, taking into account future requirements and the installation and maintenance costs. Care should be taken when using fibre optic cable to have available the specialized skill and instruments required to easily joint and repair the cable. Private voice networks should follow ITU-T recommendations regarding cabling.

Main ITU-T standards:

- ☐ Copper-based symmetric cable:

- G.611 Characteristics of symmetric cable pairs for analogue transmission
- G.612 Characteristics of symmetric cable pairs for transmission of digital signals up to 34 Mbps
- G.613 Characteristics of symmetric cable pairs for transmission of digital signals up to 2 Mbps

☐ Coaxial cable:

G.621 to 623 Characteristics of coaxial cable

☐ Fibre-optic cable:

G.651 Characteristics of 50/125 μm multimode optical fibre cable

G.652 Characteristics of single-mode optical fibre cable.

G.654 Low attenuation submarine cables

2.3 VOICE SERVICES

2.3.1 Telephone transmission quality

Private voice networks should follow ITU-T recommendations regarding absolute and relative power (loudness) levels and transmission standards. Verification of transmission plans on incoming and outgoing levels should adopt ITU-T recommended measurements and weighting factors.

Main ITU-T standards:

P.11 Effect of transmission impairments

G.101 The (Voice) transmission plan.

G.101.1 The use of the decibel and of relative levels in speech-band telecomms.

- Other standards applicable to voice over IP

P.800 Methods for subjective determination of transmission quality

P.862 Perceptual evaluation of speech quality (PESQ) for narrowband telephone networks

2.3.2 Interconnection of exchanges

Local PTO regulations shall be followed with regard to the interconnection of a private exchange to the public network. Often PTO regulations specify the use of a signalling system based on ITU-T standards.

For the interconnection of private exchanges, the network planner has a variety of options based on proprietary and de-facto standards. The decision to select a signalling system should take account of:

- ☐ Whether or not all exchanges in the network will be of the same family, i.e., the supplier's. If the same family is used, a proprietary standard providing advanced service can be adopted.
- ☐ Whether various types of exchanges from various Manufacturers will be used. In this case either a de-facto standard, supported by all of the various Manufacturers, or a signalling system based on ITU-T standard can be used.

In most cases, PTOs will employ digital signalling systems; however, the use of analogue signalling systems may apply in a number of geographies.

Main ITU-T standards:

☐ Analogue type of signalling:

Q.3XX and Q.4XX Specifications of signalling systems R1 and R2

☐ Digital Common channel signalling:

- Q.7XX Specifications of signalling system No. 7
- Q.931 Specification for ISDN user to network call control
- ☐ Accepted standards developed and agreed among various vendors:
- DPNSS No 2 Digital Private Network Signalling Standard
- Q.Sig IPNS Forum specification for ISDN user to network call control
- ☐ De-facto standard based on ITU-T recommendations:
- British Telecom
- DASS II British standard for digital signalling

2.4 DATA SERVICES

2.4.1 Data services over analogue network

Modems interfacing with analogue fixed or switched circuits should follow ITU-T recommendations for the physical layer interface and signal levels in order to meet (local) PTO-type approval specifications. If applicable, ITU-T standards should be followed for the interface between modem and terminal. The ITU-T V.2x recommendations are included here as they are still supported, although most modern modems refer only to ITU-T V.33 or V.34 or V.36 recommendations.

Main ITU-T standards:

- ☐ Physical layer interface standards:

- V.2 Signal level for data transmission on telephone circuits
- V.10/V.28 Electrical characteristics of un-balanced double current interchange circuits for data communication
- V.11 Electrical characteristics of balanced interchange circuits for data communication rates up to 10 Mbps

- ☐ Data link layer interface standards:

- V.22 bis 2400 bps duplex modem for public switched telephone networks
- V.23 600/1200 bps duplex modem for public switched telephone networks
- V.24 Interchange circuits (interface) between modem and terminal
- V.26 bis 1200/2400 bps modem for 4-wire fixed and switched circuits
- V.27 bis 2400/4800 bps modem for 4-wire fixed and switched circuits
- V.29 9600 bps modem for 4-wire fixed circuits
- V.32 2400/4800/9600 bps modem for 2-wire fixed and switched circuits
- V.32 bis 2400/4800/9600/14,400 bps modem for 2-wire switched circuits
- V.33 14,400 bps modem for 4-wire fixed circuits
- V.34 2400/33,600 bps modem for 2-wire switched circuits
- V.36 modem for synchronous data transmission using 60 kHz to 108 kHz group band circuits
- V.90 A Digital and analogue modem pair operating over the PSTN at data rates up to 56000 bps

- ☐ Network layer interface standard:

- V.42 Error-correcting procedures for DCE using async to synchronous conversion.

2.4.2 Data services over traditional packet switching networks

Private packet switching networks should follow ITU-T recommendations for public packet switching networks. Traditional packet switching networks are often referred to under the main interface recommendation "X.25".

Main ITU-T standards:

- X.3 Packet Assembly Disassembly facility (PAD) in a public data network
- X.21 (Public) data networks interface for Sync. terminals
- X.21 bis Use of V-series modems on (public) data networks
- X.25 Interface between packet mode terminals and networks
- X.28 Interface for Async terminals and (public) Packet Assembling/Disassembling facilities (PADs)
- X.29 Procedures for interchange of information between a PAD and a packet terminal or other PAD
- X.30 Support of X.21, X.21 bis and X.20 bis terminals by an Integrated Services Digital Network (ISDN).

2.4.3 Data services over frame relay networks

Data services that utilise frame relays as a means of transmission are widely used, in both private and public switching networks, and shall follow ITU-T recommendations, as outlined below.

Main ITU-T standards:

- X.33 Access to packet switched data transmission services via frame relay
- X.36 Interface between DTE and DCE for frame relay public data networks
- X.76 Network to network interface between public frame relay data transmission networks
- Q.933 Signalling Specifications for frame mode switched and permanent virtual connections

2.5 MESSAGE HANDLING SYSTEMS

2.5.1 Telex transmission

Although public telex has now been largely superseded by electronic mail and facsimile, outside the industrialised countries telex will for the coming years remain one of the most reliable public services and needed to support PETRONAS activities. International ITU-T standards apply and shall be followed in addition to local standards.

Main ITU-T standards:

- S.1 International Telegraphic Alphabet No.2
- S.12 Conditions that must be satisfied by synchronous systems operating in connection with standard 50 bps teleprinter circuits
- S.15 Use of telex network for data transmission at 50 bps
- S.21 Use of display screens in telex machines

2.5.2 Electronic mail

Electronic mail systems have replaced the public telex service in most areas of the world. PETRONAS generally utilises application software, such as Microsoft Outlook®, or Lotus Notes® is also standard. ITU-T standards apply to both the message structure and transmission protocol in addition to standards for harmonised directory services. Private electronic mail systems shall follow these ITU-T standards when interfacing the public electronic mail service.

Main ITU-T standards:

- X.402 Message handling systems: Overall architecture
- X.500 The Directory - Overview of Concepts, Models and Services
- X.501 The Directory models.

2.6 ADDITIONAL SERVICES

2.6.1 Facsimile

Facsimile equipment is used to transmit/receive documents via the public switched telephone network. Because of the open nature of facsimile, ITU-T recommendations should be followed to allow communications to all parties. Group 3 equipment is recommended for general use on any analogue or digital network. Group 4 equipment operates via (public) 64 kbps ISDN lines often more economically, but with limited interconnectivity.

Main ITU-T standards:

- T.4 Standardisation of Group 3 facsimile apparatus
- T.6 Standardisation of Group 4 facsimile apparatus
- T.22 Standardisation test charts for document transmission
- T.30 Procedures for document facsimile transmission in general switched telecommunication networks.
- T.38 Group 3 Facsimile transmission over IP networks

2.6.2 Videoconferencing

Standards are available for interactive videoconferencing via $n \times 64$ kbps digital circuits. The lowest bit rate on which videoconferencing can operate is 64 kbps, but at this rate the picture quality is limited (although advances in video codec technology are enabling this quality to be improved). Presently, the lowest acceptable speed to be offered to the general public is 2×64 kbps. Although proprietary standards may offer better picture quality than ITU-T standards, in particular on 2×64 kbps, they can only be used for inter-company conferences, and ITU-T recommendations shall be followed to allow for conferencing with third parties. It is therefore recommended to standardise on ITU-T H.320 or to select a proprietary system that will support H.320.

Proprietary systems are still common for videoconferencing; these use dial-up circuits. Until standards are widely adopted by Manufacturers, these systems can only be used between identical units and are restricted in application.

Main ITU-T standards:

- H.221 Communication framing, de/multiplexing
- H.230 Frame Synchronous control and indication signals for audio-visual systems
- H.242 Systems for establishing communications between audio-visual terminals
- H.243 Call set-up/disconnect: Multipoint, up to 1920 kbps
- H.261 Full motion video coding (a sub-set for compression of H.320)
- H.320 Narrowband visual telephone systems and terminal equipment
- H.321 Adaptation of H.320 to B-ISDN environments
- H.323 Packet based multimedia (e.g. videoconferencing) communication systems
- G.711 3.1 kHz PCM audio, 64 kbps
- G.722 7 kHz audio, 48 kbps or 56 kbps
- G.723 Speech Coders