



RP 59-2

TELECOMMUNICATIONS

SELECTION OF NETWORK COMMUNICATIONS FOR MANNED OFFSHORE FIXED INSTALLATIONS

October 1994

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BP GROUP RECOMMENDED PRACTICES AND SPECIFICATIONS FOR ENGINEERING

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**TELECOMMUNICATIONS
SELECTION OF NETWORK
COMMUNICATIONS FOR MANNED
OFFSHORE FIXED INSTALLATIONS****APPLICABILITY**Regional Applicability: **United Kingdom****SCOPE AND PURPOSE**

This Recommended Practice provides guidance on the design and selection of Telecommunications Networks for manned offshore fixed installations.

Its purpose is to provide design engineers and management with:-

- (a) Guidance on the need for and selection of telecommunication networks for manned offshore fixed installations.
- (b) A basis for designing, specifying, evaluating and selecting telecommunications networks for manned offshore fixed installations.
- (c) Guidance on health and safety aspects associated with the selection and operation of telecommunication networks for manned offshore fixed installations.

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FOREWORD

Introduction to BP Group Recommended Practices and Specifications for Engineering

The Introductory Volume contains a series of documents that provide an introduction to the BP Group Recommended Practices and Specifications for Engineering (RPSEs). In particular, the 'General Foreword' sets out the philosophy of the RPSEs. Other documents in the Introductory Volume provide general guidance on using the RPSEs and background information to Engineering Standards in BP. There are also recommendations for specific definitions and requirements.

Value of this Recommended Practice

There is no document which covers this requirement. Future applications will benefit from the ability to specify and procure such best-practice systems in a quicker and more cost effective manner. It is intended that this Recommended Practice will stimulate standard products to emerge and these will produce cost benefits compared with current bespoke systems.

Application

Text in *italics* is Commentary. Commentary provides background information which supports the requirements of the Recommended Practice, and may discuss alternative options.

This document may refer to certain local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirements lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.

Feedback and Further Information

Users are invited to feed back any comments and to detail experiences in the application of BP RPSE's, to assist in the process of their continuous improvement.

For feedback and further information, please contact Standards Group, BP International or the Custodian. See Quarterly Status List for contacts.



1. SCOPE

This Recommended Practice provides guidance on the selection of network communication systems used for manned offshore fixed installations covering; the type of services needed to communicate with the shore and other installations, and the various facilities that are required. Reasons for choosing the various alternative types of communications equipment and systems installed on manned offshore fixed installations are also given. The Recommended Practice takes into account health and safety legislation, good design practice and all technical and economic considerations.

The following aspects are not covered by this Recommended Practice:-

- (a) Telecommunication Systems for Mobile Offshore Drilling Units
- (b) Telecommunication Systems for unmanned or not normally manned offshore installations
- (c) Telecommunication Systems for temporary offshore units for construction, hook-up or workovers
- (d) Telecommunication Systems for onshore installations

The purpose of this Recommended Practice is to provide design engineers and managers with a basis for the selection of Network Communication Systems for manned offshore fixed installations. This Recommended Practice is restricted in applicability to manned offshore fixed installations because the requirements for other types of offshore installations; offshore unit or onshore installation can vary in size, capacity and regulatory requirements.

2. EXPOSITION

2.1 Telecommunications

In terms which are generally accepted Telecommunications is defined as the transportation of voice, image, text or data between physically separated points. To achieve this function, electronic devices predominate, with either cable or radio connection being employed to implement the physical interconnections. However, other mediums such as optical technology is being used in an increasing number of applications, particularly in the field of optical fibre cables, infrared and laser.

2.2 Telecommunications Systems

Within the definition of this Recommended Practice a Telecommunication System is defined as a collection of individual items of equipment interconnected by means of transmission media to form a communication network. Such a network is used to provide the transmission path for any combination of voice, image, text or data communications.



Apart from network communications, which includes communication links to the mainland and other offshore installations a number of other facilities and communication applications are used on existing offshore oil and gas fixed installations. These are generally divided into other categories as follows:-

- (a) Network Communications and Communication links (BP Group RP 59-2).
- (b) Shipping and Aeronautical Communications (BP Group [RP 59-3](#)).
- (c) On-Platform Communications (BP Group [RP 59-4](#)).
- (d) Emergency Communications (BP Group [RP 59-5](#)).
- (e) Telecommunication Power Supplies (BP Group [RP 59-6](#)).

This Recommended Practice covers the requirements for network communication systems and communication links. The other categories are dealt with in other parts of the BP Group RP 59 series and will be referred to as and when required.

3. DEFINING SERVICE REQUIREMENTS

The following section is to be used to assist in selecting a set of options available from the telecommunication network. However, further advice and assistance is available from the Custodian of this document.

3.1 Network Communication Facilities

Network communications would include all the private, national and international telephone, text, video and data communications likely to be required from the offshore manned fixed installation. The facilities required can be selected from the following:-

3.1.1 Basic Facilities

- (a) Telephone and facsimile access into the public switched telephone network (the).

Depending on the size of the operation, between three and six lines have normally been required, These are usually shared with the lines that are provided for connection to the company's private telephone network.

- (b) Telephone and facsimile communication into the company's private telephone network.

Depending on the size of the operation, between six and twelve lines have normally been required, These are usually shared with the lines that are provided for connection to the public switched telephone network (the PSTN)

It is desirable that the telephone lines to the mainland are split and then routed over two separate paths in order to maintain availability.

- (c) Telephone and facsimile communication to adjacent installations, drilling or support vessels.



It may be necessary to provide communication links to adjacent installations that are concerned with the function of the installation. pipelines may be routed through other installations, and telephone communication may be required. In addition, links may be required onto support vessels. e.g. onto an accommodation vessel during installation construction or onto a drilling vessel. Normally between two and three lines are required for each location.

- (d) Connection to the company's main computer networks for accessing data bases on materials, maintenance records, personnel etc. and electronic mail.

Depending on the size of the operation, between six and thirty remote terminals have normally been required to share and operate over the data communication channels that are routed to the mainland computer systems. It is preferable if the data link channels capacity to the mainland is split and then routed to the mainland over two separate communication paths. Dual routes are desirable in order to maintain reliability of information data relating to movements of personnel offshore. However, this form of sophistication may not be possible and an alternate route, although desirable, may not be essential unless it is the only means for carrying details of offshore movements of personnel. If an alternate main route is not available then an alternate means of communication may be needed e.g. Inmarsat with voice and facsimile facilities.

- (e) Point-to-point 'hotline' type telephone connection to an emergency incident control room.

It is preferable if this facility has two geographically separated communication routes to the mainland. This is applicable to the emergency communications hotline telephone only. However, it may not be possible to have this form of sophistication and an alternate emergency communications link such as an Inmarsat terminal may need to be provided for back-up.

The 'emergency procedures' document usually refers to a hotline link for emergency communications to the mainland during an offshore incident.

- (f) Point-to-point 'hotline' type telephone connections to the company's shore based central control room for pipeline and oil/gas production process control.

One of each of these are normally provided between the offshore central control room console and the respective onshore oil/gas operation control centres. They are usually also parallel connected to the onshore emergency incident control centre

- (g) Telemetry connections for monitoring and control of the oil and gas process systems from the onshore central control room.



One data communications channel is normally required for each set of data and each of these should be dual routed to maintain reliability of information.

- (h) Telemetry connections for monitoring and control of the fire and gas protection and emergency shutdown systems from the onshore central control room oil and gas operations centres.

One data channel is normally required for each type of connection and each of these should be dual routed to maintain reliability of information.

- (i) Telemetry connections for monitoring of fiscal metering data concerning oil and gas production rates.

One data channel is normally required and this should be dual routed to maintain reliability of information.

- (j) Telemetry connections for management information data concerned with the monitoring of oil and gas process data.

One data channel is normally required for each type of connection, but this would not normally be dual routed.

3.1.2 Other less Essential Needs

- (a) Point-to-point video conference link to the company's shore based operations centre.

A dedicated video conference link fitted with document cameras and video recorders may be useful for holding meetings or for discussions that provide technical advice to solve technical problems. The use of a document camera and a video recorder together with the video image of the person talking enables people to discuss technical drawings or videos without the need to travel offshore. It has also enabled onshore staff to acquaint themselves with problem areas before visiting the offshore installation, giving them time to think about possible solutions. The link can be provided between a dedicated office on the installation or the Offshore Installation Manager's office offshore and a dedicated operations office or a central video conference centre onshore.

Reference to standards for videoconferencing and videotelephony equipment can be found in the [CCITT F 700](#) series.

- (b) The ability to transmit documents held on 'imaging' facilities located onshore.

One data communications channel is normally required, however, this facility is not always necessary.



- (c) The ability to access onshore radio and TV broadcasts and relay these offshore for distribution to the offshore installation's entertainment systems.

This will depend on the other options available for providing this facility and it would probably be more economical to consider reception of the broadcasts direct to the installation from the vhf radio and uhf TV transmission stations onshore or from relay stations on adjacent installations or from radio satellites. This is covered in BP Group [RP 59-4](#). However, if the information is transmitted over the network facilities, then one data communications channel link would probably be required from an onshore location which has concentrated the data into one data stream. This would most probably be from services being provided by entertainment cable network operators on the mainland. It is unlikely that this form of transmission would be used unless there is a high capacity bearer link available, like an optical fibre or high capacity microwave radio link.

3.2 Defining Channel Requirements

Fundamental to defining telecommunication channel capacity are the service requirements. These should all be decided in detail based on the guidance given in section 3.1. Each facility should be considered separately before the telecommunication network channel capacity requirements can be specified.



Typical requirements for an offshore manned fixed installation could be as follows:-

Type of Traffic		Function	No of Circuits	Total Analogue Bandwidth or Digital Capacoty*		Total Availability (%) see comment below
				Main Link	Back-Up Route	
1	Speech	PSTN access	3	8 kHz 16 kB/s	4 kHz 8 kB/s	99.90
2	Speech	PABX tie lines private use	6	12 kHz 24 kB/s	12 kHz 24 kB/s	99.90

No. 2 above could be shared with Service (1) or may be split to serve different routes e.g. to an adjacent installation or other offshore installations. Digital capacity is based on 8 Kb/s per speech channel

*Digital capacity is normally available in quantities of 64 Kb/s and is shared between the various service requirements

3	Speech	Hotlines	3	12 kHz 24 kB/s	12 kHz 24 kB/s	99.95 99.99 (for emergency)
4	Facsimile	PSTN access or incl. PABX private use	2	4.8 kB/s	4.8 kB/s	99.90
5	Data	Telemetry	3	12 kHz 28.8 kB/s	12 kHz 28.8 kB/s	99.99
				(duplicated routes)		

Digital capacity for No. 5 and No. 6 below is based on 9.6 kB/s per circuit

6	Data	20 Computer Terminals via modem	2	8 kHz 19.2 Kb/s	4 kHz 9.6 Kb/s	99.90 99.99 (for personnel movements)
				(one channel on duplicated routes)		
7	Data	Document transfer	1	Nil	19.2 kB/s	99.90
				(NB. Document transfer could be on main or back-up route)		
8	Video	Video conference	1	64 kB/s	Nil	99.90

* NB:-

Total Capacity Requirements above shows that two routes are required one having 192 kB/s and the other having 128 kB/s. Each route would need an individual availability of 99.90% to achieve the total availability requirements. Requirements for relaying radio and TV entertainment transmissions are not included

Availability:-

Typically, analogue or digital channels can be considered unavailable when the signal to noise ratio in each 4 KHz (3.4 KHz) channel falls below 30 dBp or when the bit error rate (BER) is worse than one in ten thousand. However, this aspect needs to be considered carefully with other aspects of the interface e.g. with multiplexer performance.



The interface requirements for each channel should be specified e.g. [CCITT V11/X21](#) or [V24/V28](#) etc.

General Notes on dual routing are as follows:

- (a) Communications channels for services such as pabx tie-lines, where it is not considered necessary to fully duplicate, should, as far as possible, be equally routed via each link so that in the case of a single failure only half of the service capacity will be lost.
- (b) Communications channels carrying services that are critically important to the safe and efficient operation of the oil and gas export pipelines, the installation and for personnel safety should be routed via both links.
- (c) All switching of traffic between alternate routes should be a function of the end systems and not the communications links.

4. NETWORK COMMUNICATION LINKS

4.1 Types of Communication Link

Various methods of multi-channel communication links can be used for routing the range of channel information needs to shore or to other installations. These are as follows:-

- (a) Line of Sight Microwave Radio
- (b) Beyond the horizon microwave radio (diffraction path)
- (c) Tropospheric Scatter radio
- (d) Radio Satellite
- (e) Submarine cable

Criteria for selecting which type of carrier is used is dependent on regulatory aspects and cost. The following details give guidelines for the appropriate choice.

The bandwidth capacity, the range and the required system availability define the type of main bearer telecommunication link that could be used. However, each type of bearer has particular constraints which may not be suitable for the application and a choice should be made by the system designer.



The various methods of main bearer communication link that can be used for routing information are shown as follows:-

Telecommunications Link Options

Category of Link	Main Constraints	Main Application	Typically Applied Range (km)	Typical Bandwidth Capacity (A) Analogue (kHz) (D) Digital (kB/s)	*Typical Availability (%)
Line of Sight Microwave	Antenna locations and spacings	Offshore multi-channel	Up to 40	60-300 (A) 704-34000 (D)	99.99
Beyond the Horizon Microwave Radio (diffraction path)	Large antenna size	Offshore multi-channel	30-60	108-156 (A) 704-2000 (D)	99.95
Tropospheric Scatter Radio	Large antenna size and high power consumptions	Offshore multi-channel	50-500	108-300 (A) 704-2000 (D)	99.9
Radio Satellite	Antenna size, beam coverage and controlled by satellite authority	Offshore multi-channel	50-2000	64 to 2000 (D)	99.9
Submarine cable (optical fibre)	High capital and repair cost	Offshore Virtually unlimited channel capacity	Virtually unlimited with repeaters	140,000 (D)	99.999

* Note: Availability figures are only typical when MTTR values are negligible.

The type of link required should be selected based on the availability and the bandwidth requirements.

From the options described, a typical choice would probably be two digital radio satellite system operating at 192 kB/s and 128 kB/s. These would each need an antenna dish size of about two metres diameter and a low power transmitter of around 5 watts. Digital multiplexing and voice compression techniques would be used to fit the channel requirements within the available bandwidth. The system should be procured to meet the radio satellite regulatory authority's performance requirements. e.g. Eutelsat/Intelsat. However, guidance on the procurement of microwave links may be required and the following details can be used to specify the type of links required.



Further assistance can be provided from the Custodian of this document.

4.2 Microwave Radio Link System Design

This section provides general information and guidance on details that should be included in any specification related to line of sight, beyond the horizon or tropospheric scatter microwave radio links used for multi-channel communication to offshore manned fixed installations. Each application and technique is unique, however, and it should be for the system designer to clearly specify the details required. It is not possible in a document of this type to cover all the aspects that are possible and only the main features can be given as follows:-

4.2.1 General Requirements

- (a) The equipment should be type approved by the appropriate authority and should meet the appropriate DTI MPT radio regulatory specifications. The link should conform with all relevant CCIR recommendations and reports.

A list of appropriate DTI MPT specifications and CCIR recommendations and reports which systems and equipment should meet are included in Appendix B of this Recommended Practice. In addition there are many systems installed in the UK sector of the North sea which comply with British Telecom specifications, and although these are no longer mandatory they can be referred to for guidance purposes. They are also included in Appendix B. European microwave radio link standards are currently under preparation in draft form from ETSI sub technical committee TM4 and these are also listed in Appendix B. The list in Appendix B is not exhaustive as many new products exploiting new technology are becoming available. It is the responsibility of the system designer to choose the appropriate equipment and system specifications that meet radio regulatory and operational needs at the time.

- (b) The system can be either digital or analogue, but should operate in the stated frequency band with the minimum capacity of duplex channels required.

The traffic requirements should be clearly identified, as indicated in Section 3.2 including spare capacity for expansion.

- (c) Each radio terminal should consist of a minimum of two hot-standby transmitters and two receivers. Four receivers are required for tropospheric scatter routes.

Any equipment to be supplied should preferably be provided with space dual diversity. Quad diversity is required for tropospheric scatter links. One receiver should be connected to each antenna, and each polarisation in the case of tropospheric scatter, with their outputs combined, via, e.g., a maximal ratio combiner, such that the resultant baseband signal is better than either of the single signals. A single noisy receiver should not

degrade the signal quality available from the better operational receiver. Each receiver should have its own power supply unit for reliability and maintenance purposes.

The transmitters should be arranged in hot-standby (i.e. permanently powered) such that if the primary unit fails the standby unit will be automatically switched into service and there is no loss of transmission during switchover. Each transmitter should be powered from its own dedicated power supply unit for improved reliability and maintenance purposes.

The 'in service' transmitter should normally be connected to either of two antennas as appropriate to optimise space diversity operations. Facilities should be provided on the face of the equipment rack to manually switch the 'in-service' transmitter to either antenna, as necessary.

- (d) An engineer's order wire channel should be provided for system engineering purposes for use between the terminal equipment installed on the offshore installation and the remote location.

A handset, calling button, and receive call audio tone annunciator should be provided on the rack face at each location so that engineers can communicate over the link without disturbing any other services.

- (e) A supervisory alarm system should be provided in the equipment cabinet at each terminal site which should be capable of interrogating, displaying and updating information on the alarm functions relating to all equipment associated with the radio link system. Facilities should also be provided to monitor and display the alarm status indications from the remote terminal equipment at the local terminal on the installation. Cancellation of the alarm status lights should only occur when the appropriate equipment fault has been rectified.

The supervisory equipment should generate a general combined alarm for remote extension to the master supervisory system on the installation which could either be a SCADA or DCS system provided for monitoring and control of the process instrumentation on the installation.

- (f) The microwave radio system equipment should be powered from a central or dedicated ups.

See BP Group [RP 59-6](#) for further details of telecommunication power supplies

- (g) Radio links should be designed to provide an overall availability of 99.9% for the worst case channel in each direction of propagation. Speech circuit availability should be taken as better than 30 dB weighted signal to noise ratio. Data circuit



availability should be taken as a channel bit error rate of better than 1 in 10^4 .

A minimum availability of 99.9% for each link should guarantee an overall availability of 99.99% for dual links. Manufacturers should be asked to calculate overall availability figures for the link including radio path performance and equipment failures. An MTTR of four hours minimum should be used to allow for technician call out on offshore installation.

4.2.2 Radio Propagation Path Performance

A comprehensive set of calculations should be completed to confirm the radio propagation performance predictions for the radio links.

The overall availability requirement of 99.9% includes equipment failures. However, from past experience of over water microwave link paths most outages are caused by radio path propagation failures. Calculations should show all formulas/parameters used together with a copy of any drawings, graphs, charts and tables used for data extrapolation. All assumptions made and method of calculations should be clearly stated so that future amendments and verifications can be clarified easily, as appropriate.

Calculations should be presented in tabulated form to show the following parameters for the worst case channel for the link:-

- (a) Median (50%) Noise without diversity.
- (b) Noise Power, Signal to total Noise ratio and Noise Power Ratio under fading conditions without diversity. (99.99% values and 80.00% values should be calculated in accordance with [CCIR and NBS 101](#) recommendations).
- (c) Noise Power, Signal to total Noise Ratio and Noise Power Ratio under fading conditions with diversity. (99.99% values and 80.00% values should be calculated in accordance with [CCIR and NBS 101](#) recommendations).
- (d) Error rate performance in accordance with [CCITT recommendation G.821](#).
- (e) Antenna parameters considering the following:-
 - (i) Size
 - (ii) Height, above mean sea level
 - (iii) Diversity spacing
- (f) Path length and azimuth bearing calculations.

An estimate of fade losses due to multipath propagation mechanisms, tropospheric scattering, elevated tropospheric layers and ducting should be calculated.

The following parameters should be identified by the system designer when preparing the system calculations:-



<i>Earth Radius Factor (K):</i>	<i>Range as defined but typically 0.7 to infinity for 99.9% of the time.</i>
<i>Tide Sea State Variation (T):</i>	<i>Typically ± 3 metres amsl (This should be verified for each location independently, as wrong estimates could lead to incorrect design of diversity antenna arrangements).</i>
<i>Reflection Coefficient (R):</i>	<i>For over sea water paths this is normally taken as minus one. However, this is a complex function dependent on conductivity and relative permittivity, which could be significant when calculating diversity separations on relatively short paths.</i>
<i>Frequency (F):</i>	<i>Typically 1500 MHz, 1800MHz, 7500 MHz, 13000 MHz and 22000 MHz links are used. However, equipment operating at other frequencies in the 38 GHz, 55 GHz and 58 GHz bands are becoming available.</i>

The antenna heights, antenna feeder lengths and types approved for design should be derived from finalised agreed practical location as acceptable, to guarantee performance.

The position of the antennas on the installation should be carefully considered. The antennas should be mounted in locations that are suitable for maintenance access but should be well away from any other structures that are likely to block the radio paths or beams. Crane loading and unloading activities should be considered in detail so the position of any crane jibs or loads are avoided. This should take into account all likely locations of supply boat loadings and other support vessels and helicopter movements e.g. accommodation vessels during hook-up and construction, drilling vessels and vessels for workovers.

It is often necessary to mount antennas on or very close to flare towers and if required heat shields should be fitted to protect the antennas from the radiation heat generated. Temperatures up to 90°C are usually acceptable for the antenna alone, but where equipment may be collocated in an antenna hub the temperature should normally not exceed 40°C. However, there is no effect of flares on radio propagation that would significantly affect radio transmission.

The design of the antenna mounting steelwork on the installation should take into account movements and vibration of the installation caused during rough weather and installation operations. For this reason the antennas should be mounted on a purpose built rigid part of the structure. This is especially critical for large dish antennas which have narrow beam widths, they should be mounted well away from any sources of vibration e.g. drilling operations. Allocation of the respective tolerances for antenna movements due to wind forces are detailed in EIA RS 222 specification.

The space diversity antenna separations and respective antenna feeder lengths at both the local and remote ends of the link should be calculated and verified. Interim calculations may be required to determine satisfactory antenna locations. For line of sight and diffraction path links the worst case clearance should be established with $K = 0.7$ and maximum tide/sea state amsl. The best case clearance



should be established with $K = \text{infinity}$ and minimum tide/sea state amsl. The diversity spacing provided should protect against fading from sea reflections and tropospheric layers for all clearance conditions between the extreme values stated. The method used for establishing diversity improvement applicable to overwater paths should be confirmed. Normally diversity spacing calculations are based on [CCIR](#), [NBS101](#), Vigants and Millington Rules. The improvement figure for the worst case condition of effective Earth Radius Factor is defined in [CCIR Report 563](#).

4.2.3 Multiplexer Equipment

Multiplexer equipment should be supplied as required along with the respective analogue or digital radio equipment at both locations. The Multiplex equipment should conform to CCITT Recommendations. The transmit and receive levels should be stated to meet system interconnection requirements.

A list of applicable CCITT recommendations is included in Appendix B. Multiplex equipment is generally covered by the CCITT G series.

For ease of maintenance and to achieve flexibility in capacity and bandwidth, programming of the equipment should be available locally on the equipment. Means should be provided to synchronise the system with a reference frequency such that there is end to end timing and frequency synchronisation over the network. Expansion and reduction to or from the maximum capacity of the multiplexer unit should be achieved with the minimum disruption to working systems and should only involve the insertion of additional equipment cards into existing frames/shelves. The analogue interfaces normally used on the channel audio input/output circuits from the multiplex equipment are presented as either 2 wire or 4 wire, 600 ohm, balanced terminations with either [BTNR 181 SSAC15](#) or [BTNR 182 SSDC5](#), E&M signalling. The end to end path gain should be determined from the system characteristics and the line cards should be capable of adjustment over the dBm level range required.

Shutdown relays or equivalent should be provided in the circuits linking the multiplex ports to other equipment that are located in other gas detection zone areas.

The relays are required to isolate the remote equipment from the electrical source of power in the microwave equipment, if gas is detected in the remote but normally safe areas. The operation of the relays will be controlled by a signal from the Emergency Shut Down (ESD) system. If the remote equipment is located in the same gas detection zone as the microwave equipment then isolation relays are not required since the electrical power will be isolated at source. This is normally applicable to hotline telephone circuits.

4.3 Radio Satellite Communications Link System Design

This section describes the main aspects of a digital radio satellite communications system telecommunications link for routing communications channels from the installation.



For dual routes two links will be required. e.g. one link could be a radio satellite link and the other a microwave radio link. However, if two radio satellite links are being provided then it is preferable if two separate and independent radio satellite earth stations are provided on the installation. Each earth station should have identical equipment to allow common spares holdings and maintenance routines so that each earth station can provide the redundancy for the other. In this case each earth station would only require to have non-redundant sub-systems except where it is essential to meet availability requirements. Each offshore earth station should operate to a different radio satellite and a different onshore earth station at geographically diverse locations to provide system redundancy and to avoid simultaneous rain fade of the circuits due to onshore rainfall.(CCIR report 563 suggest a minimum separation of 10 km).

4.3.1 General Design Requirements

The design of the system should be based on the following general criteria:-

- (a) The equipment should be type approved by the appropriate authority and should comply with the mandatory requirements of the radio satellite owner's specifications. The link should conform with all relevant CCIR recommendations.

A list of appropriate CCIR recommendations and Eutelsat/Intelsat performance specification needs which systems and equipment should meet are included in Appendix B of this Recommended Practice. This list is not exhaustive as many new products exploiting new technology are becoming available. It is the responsibility of the system designer to choose the appropriate equipment and system specifications that meet radio regulatory and operational needs at the time.

- (b) The system should be configured such that no single failure of any equipment item supplied as part of this system should result in the loss of services critical to the operation or significantly affect more than half the capacity of the services. The radio satellite system equipment should be powered from a central or dedicated ups.

i.e. critical items of equipment such as the HPA, should be duplicated, however, see comments above. See BP Group RP 59-6 for further details of telecommunication power supplies.

- (c) The satellite circuits availability, bandwidth and error rate should be specified to the level required to meet the required availability, capacity and performance of the communications channels required.

The traffic requirements should be clearly identified, as indicated in Section 3.2 including spare capacity for expansion.

- (d) The communications channels should be available and capable of providing an acceptable service for 99.9% of the year on each circuit. Comprehensive calculations should be submitted to justify the design. Digital data channels should be considered to be available when the bit error rate is less than or equal to 1 in 10^4 .

A minimum availability of 99.9% for each link should guarantee an overall availability of 99.99% for dual links. Manufacturers should be asked to calculate overall availability figures for the link including radio satellite path performance and equipment failures. An MTTR of four hours minimum should be used to allow for technician call out on offshore installation.

- (e) The antenna sub-system should comprise the reflector system, dual polarised feed horn, low-noise amplifiers (LNA), high power amplifiers (HPA), tracking mechanism and mounting structure.

The low noise amplifier (LNA) and the high power amplifiers (HPA) should be located on the antenna hub in a suitable environmental enclosure. Equipment cabinets should be provided and located within a telecommunications equipment room which should be a minimum distance from the antenna. This distance should be confirmed with the manufacturer. Where the antenna assembly is mounted close to a flare a heat shield should be fitted to protect the assembly from heat radiation. Temperatures up to 45°C are usually acceptable within the antenna hub enclosure.

The equipment is mounted externally and it will therefore be necessary to take precautions against the ignition of an inadvertent release of hydrocarbons. In this situation the externally mounted antenna hub should be protected with gas detection shutdown relays or equivalent or certified to meet BS 5501 and BS 5345 for Zone 1 area hazardous environments.

- (f) The antenna should be capable of being pointed, using manual adjustments, to the nominal position of the nominated geostationary satellite and at an elevation above the horizontal determined by the location of the offshore installation. Access to the nominated radio satellite and other planned satellites should be possible.

The radio satellite antenna's position on the installation should be carefully considered. The antenna should be mounted for ease of access for maintenance but be well away from any other structures that are likely to block the radio path or beam. Crane loading and unloading activities should be considered in detail so the position of any crane jibs, wire ropes or loads are avoided. This should take into account all likely locations of supply boat loadings and other support vessels and helicopter movements



e.g. accommodation vessels during hook-up and construction, drilling vessels and vessels for workovers.

- (g) Where relevant the antenna system should be capable of automatically following the drift movements of the selected satellite over its range of drift allowed during the satellite's operational life. The antenna should be capable of tracking the selected satellite without manual intervention.

The design of the antenna tracking system should take into account movements and vibration of the installation caused during rough weather and installation operations. For this reason the earth station should be mounted on a purpose built rigid part of the structure well away from any sources of vibration e.g. drilling operations. Satellite tracking would not normally be required.

- (h) The baseband and rf modem equipment should consist of all of the elements required to convert the digital data stream to the rf frequency band and vice versa. It should be possible to alter the data rate without recourse to major equipment change outs and with minimal interruption to the service.
- (i) The satellite communications system should include intelligent multiplexing equipment to derive the individual communications channels, and should include speech compression equipment to minimise the bandwidth required for each speech channel. Speech echo suppression equipment should be included.

It should be possible to configure the multiplex unit for speech or data use as required from the front panel of the unit. Typically speech compression will allow good quality speech at 8kB/s. Means should be provided to synchronise the system with a reference frequency such that there is end to end timing and frequency synchronisation over the network. The analogue interfaces normally used on the channel audio input/output circuits of the multiplex equipment are presented as either 2 wire or 4 wire, 600 ohm, balanced terminations with either [BTNR 181 SSAC15](#) or [BTNR 182 SSDC5](#), E&M signalling.

- (j) Shutdown relays or equivalent should be provided in the circuits linking the multiplexer ports to other equipment that are located in other gas detection zone areas.

The relays are required to isolate the remote equipment from the electrical source of power in the radio satellite equipment, if gas is detected in the remote but normally safe areas. The operation of the relays will be controlled by a signal from the Emergency Shut Down (ESD) system. If the remote equipment is located in the same gas detection zone as the radio satellite equipment then isolation relays are not required since the electrical power will be isolated at source. This is normally applicable to circuits used for hotline telephones.



- (k) The terminal equipment should include sufficient alarm and monitoring facilities to enable the operational status to be readily assessed by the inspection of a comprehensive local display.

The supervisory equipment should generate a general combined alarm for remote extension to the master supervisory system on the installation which could either be a SCADA or DCS system, normally provided for monitoring and control of the process instrumentation on the installation.

4.3.2 Radio Satellite Space Segment Circuit Requirements

It should be recognised that the radio satellite equipment supplier will not provide the radio satellite space segment but they should prepare the specification for these services to be provided as part of the radio satellite communications system. These services can be the subject of a separate service contract. The equipment supplier may be responsible for specifying and commissioning these services, in conjunction with the space segment supplier.

The earth station equipment supplier should be technically responsible for the satellite circuits, which form part of the system. The bandwidth of the satellite circuits should be the minimum required to meet the initial capacity requirements and the availability and error rate should be specified to meet the required performance of the communications channels as stated. For dual routes using two radio satellite links, two separate and independent satellite circuits are required operating via different satellites and geographically diverse onshore earth stations. Each circuit is normally backhauled to the company's office on the mainland, via digital services leased from the local telecommunication company operator.

Radio satellite space segment circuit performance figures are often quoted for an availability of 99% at a BER of 1 in 10^6 . It is therefore necessary to modify the calculations to show the availability for a BER of 1 in 10^4 . In addition availabilities are quoted for each direction of the total satellite path i.e. for each direction of the link the calculations include for rain fading in the 'up-link' and the 'down-link' simultaneously. The amount of rain fade loss is allocated proportionally in each half of the path so the total amount of rain fade loss represents the amount of rain for 99% of the time. However, rain normally only occurs in either the up or down part of the link and rarely simultaneously. Calculations should therefore be carried out to show the BER when the 99.9% figure for rain losses is allocated in the up and down links individually. The result should be a minimum BER of 1 in 10^4 .

4.4 Optical Fibre Submarine Cable Systems

At this stage no optical fibre submarine cable systems have been implemented to offshore installation through prohibitive costs. In the future this may not be the case and as technology develops a standard may be produced at a later date.



The first choice for any communication link to offshore installation has been radio. The vast amount of additional capacity available from an optical fibre cable system, although attractive at first sight has never been economically justified. Other techniques enabling economical use of bandwidth have been preferred.

5. DATA COMMUNICATIONS SYSTEM

This section describes the requirements for a private data communication system which should interconnect with the communication link on the installation and the company's onshore location:-

- (a) The system should be capable of relaying digital data via the communication link(s) from computer terminal devices and printers on the offshore installation to the company's onshore computer network.

At the onshore office certain circuits may be extended by private wire to a number of other onshore office locations and to other locations, as appropriate.

- (b) The circuit routing from the installation to the onshore network should be via the dual routed main communications system linking both locations. Data traffic should be routed via both circuits on a shared basis so that the system is resilient to a single link failure. The equipment should incorporate sufficient redundancy and standby equipment units to fulfil the reliability objectives.

Traffic balancing techniques can be used to provide an evenly distributed load to each of the two output ports and to maximise throughput of the data to be transmitted. Should either of the two output ports or paths fail, all traffic should automatically switch to the remaining operational route without loss of data over the communications circuits. Traffic balancing would normally be automatically restored when both data paths return to normal operations.

To prevent loss of data during peak operation, traffic flow control facilities should be provided. In-band control using standard ASCII x-on (DCT) or x-off (DCE) control characters and out-of-band control of the EIA control functions CTS/DTR, would normally be used. The equipment should be able to automatically select the code and speed appropriate to the communicating terminal devices. Facilities should be front panel selectable by the operator for ease of maintenance.

The multiplexer equipment should be capable of retaining data in memory in the event of mains power failure, preferably through the use of non-volatile logic circuitry. The use of internal batteries within the onshore equipment is an acceptable method of memory protection but offshore the batteries' capacity should be limited to 5.5v and 4AH in order to reduce the risk of ignition.



- (c) The system end to end transmission performance from terminal location to onshore network port should be so designed that any errors that occur on the links will be absorbed by the data system, and the equipment should incorporate error control facilities to minimise the number of errors in the received data.

The error control facilities should be optimised for use over radio satellite communication links and sufficient data buffering should be provided.

- (d) The system should be approved for connection to public telecommunications networks.
- (e) The equipment should be supplied complete with all hardware, software and firmware facilities necessary for system operation, and the network should be configured such that terminal devices can share the data facilities available. Compatible interfaces should be provided for connection to all input and output equipment specified.

Either statistical multiplexers and line drivers or hubs/file servers/10 BaseT cabling would probably be used although other types may be acceptable. Consideration could also be given to the use of radio lan techniques in order to reduce cabling requirements.

Interfaces could be either [CCITT V24/28](#), [X21](#), [X21 bis](#), [V11](#), [V35](#), [EIA RS 232](#), or [ISO RJ45](#), [RJ11 10](#) BaseT etc. All interconnecting cabling including patching facilities between the hubs/file servers, statistical multiplexers/modems as required from the data terminal equipment should be provided.

- (f) The data communications system equipment should be powered from a central or dedicated ups.

See BP Group [RP 59-6](#) for further details of telecommunication power supplies

- (g) The terminal equipment should include sufficient alarm and monitoring facilities to enable the operational status to be readily assessed by the inspection of a comprehensive local display.

The equipment should generate a general combined alarm for remote extension to a master supervisory system on the installation which could be either a SCADA or DCS system.

- (h) Shutdown relays or equivalent should be provided in the circuits linking the data communication ports to other equipment that are located in other gas detection zone areas.



The relays are required to isolate the remote equipment from the electrical source of power in the central data communication equipment, if gas is detected in the remote but normally safe areas. The operation of the relays will be controlled by a signal from the Emergency Shut Down (ESD) system. If the remote equipment is located in the same gas detection zone as the central data communication equipment then isolation relays are not required since the electrical power will be isolated at source. Alternatively, relays could be avoided and it may be possible to split the central equipment so that the potentially hazardous area data communication ports and the non hazardous ports are separated, and individual power supplies are used for each. This way the power supply units can be isolated separately by different ESD control signals. The requirement to isolate is normally applicable to data terminal equipment that is located in remote parts of the installation e.g. the tool pushers office and mud logging cabin.

6. TELEPHONE COMMUNICATION SYSTEM

An outline specification for the system should be based on the following:-

An automatic telephone system should be provided for telephone voice communication throughout the installation. Facilities should be included for connection into the onshore public switched telephone network, for inter-telephone network tie-lines and for interfaces to the installation's handportable radio and radio paging systems. The telephone exchange system and all component equipment should meet the requirements for connection to the public switched telephone network (PSTN). Circuits for connection to the PSTN and for inter-PABX tie-line circuits will be transmitted over a radio link.

The telephone communication system should provide telephone extensions for various quantities of internal and external locations located on the installation. (Typically between 25 and 200). The PABX will need to be provided with signalling interfaces for interconnection to the PSTN (Public Switched Telephone Network), the company's private telephone network i.e. tie-line trunks, and for long-line extensions to other installations or vessels. Any specification for the equipment should include a full range of features and class of service flexibility, including the ability to operate within the company's linked numbering scheme. Full details of the required networking features required should be included in the system definition. All telephone instruments would preferably use DTMF timed break recall, push-button keying for ease of installation cabling. However, see BP Group RP 59-4 for details of telephone instruments. A quantity of card-phones would also be required to be installed in booths on the installation for staff to use for personal calls to shore. The cardphones should be connected to the PABX and would be allocated a suitable class of service for access to the public network.

6.1 Operational Requirements for the Telephone System

6.1.1 General

The telephone system should provide external and internal telephone communications facilities for various locations on the installation, and should adhere to the company's telephone philosophy, i.e. services,



facilities numbering scheme and how the network is used should, be consistent with the company's stated practice. Special restrictions on calls and services may be introduced for connection to the PSTN. The telephone system should use a common numbering and signalling scheme and be designed so that its services are integrated with the company's existing telephone network.

For PABXs installed in the UK sector of the North Sea compliance with BS 6204, BS 6301 and BS 6450 are required. The PABX should also have the British Approval's Board for Telecommunications (BABT) approval for connection to the UK Public Switched Telephone Network (PSTN)

6.1.2 Telephone Extension Services

The telephone system should provide telephone services to all telephone extensions. Unless otherwise indicated, the services should apply to extension to extension calls on the installation and within the company's telephone network. The services provided should comply with the definition stated in the CEPT 'Handbook on services and facilities offered to subscribers in modern telephone systems'.

Typically the following facilities may be required:-

- (a) Direct dialling
- (b) Call forwarding/follow me
- (c) Immediate diversion/follow me (with distinctive dial tone to extension users with this feature active)
- (d) Diversion on busy (with distinctive dial tone to extension users with this feature active)
- (e) Diversion on no reply (with distinctive dial tone to extension users with this feature active)
- (f) Three party service (hold and transfer)
- (g) Fixed destination call (hot line)
- (h) Permanent connection
- (i) Call waiting (pre-emption and camp on busy)
- (j) Priority
- (k) Completion of calls to busy subscriber (automatic ringback)
- (l) Conference (six party set-up and three party set-up)
- (m) Calling line identification
- (n) Automatic alarm service (wake up)
- (o) Direct Outward Dialling (DOD) (as required for selected extensions)
- (p) Direct Inward Dialling (DID) from public network (as required for selected extensions)
- (q) Abbreviated dialling (including DOD destinations)
- (r) Call pick-up
- (s) Call on hold
- (t) Do not disturb
- (u) Executive Intrusion
- (v) Intrusion Inhibit

Network Facilities

Adequate network facilities should be available to provide the features described above.



Facilities needed are likely to be:-

- (a) First extension call clearing
- (b) Closed user groups
- (c) Supervisory signals (BS 6450)
- (d) Free numbering within the area network
- (e) Alternative routing
- (f) Power Fail Trunk to Extension diversion
- (g) Call restrictions
- (h) Differential Ringing Cadence (internal/external)
- (i) Operator services
- (j) System Short Codes
- (k) Group hunting
- (l) Partial Short Codes
- (m) Priority
- (n) Digit Translation (16 digits/200 numbers)

Not all the features described above may be needed, however, the list above can be used to decide which are necessary at the time

6.1.3 Maintenance Facilities

The maintenance tasks for the telephone system should be performed from a central location. There should be one maintenance terminal on the installation and facilities provided for connection to a remote terminal at another location within the company's telephone network.

The maintenance terminal provided should be capable of making changes to extension numbers, extension facilities, system features, trunk circuit allocation, access codes and remote authorisation codes. An access code/password would normally be required to access the system from the terminal. The terminal equipment should include a CRT display with separate keyboard and a printer.

Functions that are to be typically controlled could be:-

- (a) Extension user details
- (b) Vacant extension line details
- (c) User class of service categories
- (d) Hot lines and sole user connections
- (e) Network monitoring/Fault Diagnostics/Routine self test
- (f) Traffic monitoring
- (g) Call recording
- (h) Permanent connections
- (i) Routing and Level Barring
- (j) Abbreviated dialling codes and directories
- (k) Forced release and howling (high volume signal extended to off-hook extension)
- (l) Alarm handling

The maintenance terminal may be required to serve more than one PABX in the network.



The PABX should also be able to accept control from more than one maintenance terminal. A priority system should be implemented to avoid control conflicts. Local override should be the control priority and default position.

6.1.4 Operator Facilities

The telephone system should include adequate facilities for operator assisted calls. One or more operator consoles may be required to provide for assistance with answering incoming calls and call setup.

One console would normally be installed in the Central Control Room/Radio Room or this may be dealt with by the company's private telephone network operator onshore. If required each console should be equipped with a display providing the following information to the operator:-

The operator functions normally required would be as follows:-

- (a) *Extension of incoming calls from external network to any local extension*
- (b) *Camp-on for incoming calls to busy extension*
- (c) *Dialling into external network whilst holding local extension*
- (d) *Intrusion*
- (e) *Trunk offering*
- (f) *Display of caller's and calling line's directory number*
- (g) *Display of number of calls in queue waiting for attention*
- (h) *Display of trunk occupancy*
- (i) *Display of busy/idle status of any called extension*
- (j) *Metering of external calls set up by the operator.*
- (k) *Display of alarms from the equipment*

Not all the above features may be required, however, the list can be used to determine exact requirements.

6.2 System Configuration

6.2.1 General

The telephone system classes of service should be defined for each telephone extension required and these should be set-up as part of the initial configuration including trunk access groups, routing and level barring.

The telephone system can be built as a centralised star network or a distributed network when a number of nodes are mesh connected.

The distributed network may be applicable when the installation is large and it would be more economical to have this form of network to reduce cabling requirements.

6.2.2 System Capacity Expansion and Performance

- (a) The telephone system provided should have capacity for the quantities of exchange lines, extensions, inter-network tie-lines, traffic requirements and estimated growth. The system's busy



hour grade of service should not be less than 0.01 for external or internal calls.

The telephone system should be able to handle call rates during normal operations.

- (b) The telephone system should cover the stated internal and external connection telephone requirements for all areas of the installation and should be able to carry 0.1 Erlang per extension of two-way traffic. For external traffic i.e. to/from the company's network, to/from other networks or to/from the PSTN, the telephone system should be able to carry a traffic of 0.9 Erlang/external line. The total calling rate for the system should be 10 calls/extension/hour e.g. for a system with 50 telephone extensions the call rate should be 500 calls/hour.

It may be necessary to expand the system in stages as the installation is established. In which case increasing the size of the system at a later date may be a consideration.

- (c) If the telephone system is to be expanded at a later date then it should be possible to extend from the equipped level to 'wired' level by merely plugging-in circuit cards as required and then bringing them, into service. To this end sufficient spare slots should be available and all sub-equipped card slots and shelves should be fully wired including wiring to the MDF. The systems database should also be fully configured to the 'wired' level. The provided and ultimate capacity of the system should be fully defined with respect to equipped capacity, spare capacity card slots and cabinet space. The telephone system should be capable of expansion from the 'wired' level to the ultimate capacity by only adding extra equipment mountings for exchange line cards, extension circuit cards, inter-network tie-line cards and associated wiring to the MDF. No changes should be necessary to the system processor or memory in order to expand the system to the ultimate capacity.

The above details avoid any confusion when requesting manufacturers to state the various capacities of the telephone system provided, i.e. 'equipped', 'wired' and 'ultimate' capacities should be clearly defined so the system designer has full knowledge of the capability of the system.

The telephone system should be equipped with 20% spare line terminations above the planned number of installed telephone lines and should be expandable by insertion of plug-in units up to an additional 20% of the installed number of line terminations.

All spare circuits provided should be fully configured within the systems database so that they can be incorporated into an existing or additional



private circuit route by commands from the operation and maintenance terminal.

- (d) Information should be provided giving details of the electrical and transmission performance of the telephone system

i.e. the maximum attenuation, quantisation distortion, echo and propagation delay which can be encountered by a call between any telephone extension and the interconnection point to the public switched telephone network (PSTN) should comply with PTO recommendations.

6.2.3 Numbering Plan

The numbering plan should be consistent with the company's telephone network.

The basic numbering plan is:-

100	Operator
101 - 199	Dedicated common numbers/Short codes
2xx - 3xx	Extensions
4, 5, 6	Access to PA, Paging, or UHF Network.
7	Area codes within the BP Exploration network
8, 9 or 0	Public network

Local numbers may have 2, 3 or 4 digits

The numbering plan used should be verified with the existing operations personnel before commencing detailed design.

6.3 Equipment Design

6.3.1 Reliability and Safety Aspects

- (a) The telephone system equipment should be fully modular utilising stored program control (SPC). The equipment may be centralised or distributed. Reliability of the telephone system is critical to operations and certain safeguards should be put into place to avoid complete failures. This applies to software failures, equipment failures, system failures, operator mistakes, fire, physical damage and power failures. In particular, no single equipment failure should be allowed to cause total disruption of service of the telephone system.

If a centralised telephone system is used all main switching equipment should be located in a dedicated telecommunication equipment room (TER). Telephone extension lines should be terminated on an MDF, and trunk lines (digital or analogue) should be terminated on the Intermediate Distribution Frame (IDF) with a patch panel and testing facilities. If digital 2MB/s trunk lines are used, a coaxial patch panel should be used with testing facilities. The central equipment should be designed and



installed such that the consequence and propagation of failure are minimised. Faulty modules should be able to be easily replaced, and expansion and reconfiguration of the quantity of telephone extensions, junction circuits or traffic capacity should be easily achieved. The system should be configured with redundant processors, memories and switching matrices to guarantee system performance in the event of a single processor, memory or switching matrix failure. The mode of operation of the processors could be either parallel, load sharing or hot standby. Each processor should be capable of addressing, writing to and reading from each memory. In the event of a processor failing, the remaining processor(s) should be capable of performing all of its functions and of handling the expected number of Busy Hour Call Attempts (BHCA) for the complete system at its ultimate size. Each memory should be continually updated on the status of call set-up and in the process of being set-up and on feature activation to enable the system to continue uninterrupted operation in the event of one memory failing. The system should provide the ability to re configure memory units in order to eliminate faulty sub-units.

Each switching matrix should be capable of carrying all of the system busy-hour traffic. In the event of the active switching matrix failing the standby switching matrix should take over all calls in progress and in the process of being set-up without interruption.

The system generic program and the database should be held on a duplicated magnetic medium, which should be periodically updated from the system memory to incorporate changes to the database made by the system supervisor or the designated maintainer. In the event of data in all memories being lost or corrupted, the memories should be automatically reloaded from the magnetic medium. The type of magnetic medium proposed should be either tape cassette, floppy diskette, Winchester disk, etc., and the time required to reload the system memories should not exceed one minute.

- (b) The maximum number of extension and/or trunk circuits which may be adversely affected by any single unit failure should be kept to a minimum.

The number of extensions/trunk circuits that could fail at one time is largely dependent on the number of circuits mounted on one printed circuit board (pcb). Typically 8 extensions or 4 trunks would be mounted on one pcb., but this could be as low as 4/2 or as high as 16/8. A compromise between this and the amount of space available needs to be taken into account.

- (c) If the installation is large and there is more than one equipment room location available, a distributed solution could be used. The telephone system's equipment would be divided between two or more nodes interconnected by a mesh network, each node having the capability of autonomous switching. It should also be co-located with a main distribution frame(MDF)for termination of extension lines. For a centralised telephone



system the cabling should be in a star configuration originating from an MDF. In a distributed system where the telephone system would be constructed from inter-linked distributed nodes, each node would have a star network from a local MDF.

All cabling from the PABX should be taken to a main distribution frame(MDF) for interconnection flexibility/cabling reliability (jumping) purposes of equipment lines to remote externally connected wiring. The MDF should be located to allow access to cable pair terminations from both equipment and remote cabling. All remote telephone outlets and telephone sets should be plug/socket type and should be connected to the MDF(s) by two pairs. Cables should be flame retardant and comply with British Telecom standards. See BP Group [RP 59-11](#) for further details of installation practices. For reduced cabling, consideration should also be given to using optical fibre or radio techniques(e.g. [DECT/CT2](#) standards).

- (d) The telephone system equipment should be powered from a central ups or alternatively, the equipment may be powered from a dedicated no-break power supply with battery bank and charger. Telephone sets would generally be line powered. Local power would normally be accepted only for telephone sets and other terminals which do not serve emergency purposes. The operator console(s) should be powered from the ups or dedicated power supply. The maintenance terminal would be powered from a local regulated supply.

See BP Group [RP 59-6](#) for further details of telecommunication power supplies and BP Group [RP 59-5](#) for details of emergency systems.

- (e) A supervisory system should be provided which is capable of carrying out automatic fault diagnosis of the telephone system. The supervisory system should be capable of displaying and updating alarm function information relating to all equipment associated with the telephone system.

The supervisory equipment should generate a general combined alarm for remote extension to the master supervisory system on the installation which could either be a SCADA or DCS system, normally provided for monitoring and control of the process instrumentation on the installation.

- (f) Shutdown relays should be provided in the circuits linking the external trunk lines and telephone extension ports to other equipment that is not intrinsically safe or flameproof and which is located in other gas detection zone areas.

The relays are required to isolate the remote equipment from the electrical source of power in the telephone system's main equipment, if gas is detected in the remote but normally safe areas. The operation of the relays will be controlled by a signal from the Emergency Shut Down (ESD)



system. If the remote equipment is located in the same gas detection zone as the telephone system equipment then isolation relays are not required since the electrical power will be isolated at source. This is normally applicable to circuits used for standard telephone extensions located in remote parts of the installation. However, fitting flameproof telephones in this situation offers a more reliable solution. On past projects it has been incorrectly assumed that it is always necessary to fit these relays to all circuits that are connected to standard telephones because the telephone system is required to operate while the installation is being evacuated, and those telephones which are certified for operation in Zone 1 hazardous areas will need to remain in operation. This is not always the case and the emergency shutdown system may isolate power to the telephone system when it has been decided to abandon the installation. In which case these relays will not be required since the power will be isolated at source. For further advice on this matter please see BP Group [RP 59-5](#) on emergency communication systems.



Standard physical and network interfaces should be used for all external connections and these should be confirmed with the design requirements of each facility required.

e.g. the signal levels should be specified in absolute levels and test tone level defined as 0 dBm according to [CCITT rec. G711](#). A-law encoding should be used for network compatibility. Interface electrical characteristics are typically; input level: +1dBm and output level: - 4 dBm

The following types of telephone extension and inter-system interfaces can be provided:-

- (a) *Analogue Telephone Extension Interface (2-wire). This is the interface to be used for standard analogue telephone sets. Selection signalling can be decade pulse dialling (10 impulses per second) international dialling code, or MF4 Dual Tone Multi Frequency (DTMF) signalling according to [CCITT rec. Q.23](#). Each line circuit should be able to accept any of the two types of signalling systems.*

Recall signalling can be ground on one wire or timed line break for 40 to 150 ms. Both systems should be available.

- (b) *Data Terminal Interface. This interface should be according to [CCITT Rec. G703](#).*
- (c) *Synchronous/Asynchronous Data Interface. This interface should be used for data terminal equipment with V.24 interface. Electrical characteristics in accordance with [CCITT rec. V.28](#), [V.10](#), [V.11](#), [V.35](#).*
- (d) *Digital Telephone Set Interface. Interfaces to digital telephone set(s) may be required and the cabling could be a 2-wire or 4-wire interface. Each manufacturer tends to have unique methods, however, the signalling scheme should allow for advanced services activated by function keys on the telephone set. In particular, display of calling line identifications on the telephone set should be provided.*
- (e) *Two wire or Four-wire Analogue Interface with E & M Signalling. These interfaces are intended for interworking with other systems. They may be accessed from a telephone extension by dialling an extension number or a trunk access code. Possible systems to be interfaced are the public address and alarm system or inter-communication system, or the uhf handportable radio and radio paging systems.*

The following types of network interfaces could be provided:-

- (a) *2 MB/s Digital Interface with Common Channel Signalling. The bit rate, frame structure and electrical characteristics should be in accordance with [CCITT Rec. G.704](#) and timeslot 16 should be used to carry the common channel signalling. The signalling should be in accordance with the common channel signalling system used in the company's private network. In the UK the signalling would normally be in accordance with [BTNR 188](#) DPNSS (Digital Private Network Signalling System).*

- (b) *2 MB/s Digital Interface with Channel Associated Signalling. The bit rate, frame structure and electrical characteristics should be according to [CCITT Rec. G.732](#). This interface would normally be used for connection to the public switched telephone network or other external networks not offering compatible common channel signalling.*
- (c) *Analogue Interface with Common Channel Signalling. For routes where digital transmission is not feasible or where less than 30 channels are needed, four-wire analogue voice circuits may be used. A separate channel can either be digital or analogue via a modem with a data speed of 4800 b/s. For the UK, digital signalling over analogue routes would normally be in accordance with [BTNR 188 APNSS](#) (Analogue Private Network Signalling System).*
- (d) *Analogue Interface with E&M Signalling. For routes where digital transmission is not possible, and common channel signalling is not possible or not required, this interface can be used. For the UK, signalling between PABX's would normally be in accordance with [BTNR 181 SSAC15](#) or [BTNR 182 SSDC5](#) (E&M) British Telecom Signalling Standards.*

7. HOTLINE TELEPHONE SYSTEM

Each hotline telephone system should provide a point to point, direct speech communication, single channel telephone facility between the offshore installation and a nominated onshore location. The hotline telephone links should be independent of the main telephone system and should be routed over the single or dual radio communication channels provided. Full speech and signalling features should be available so that individual outstations can converse either individually or in a conference mode. Outstations should be able to be called individually or as a group. Each system should have a distinct and separate, programmable, link numbering scheme.

Normally two or three independent hotline telephone systems are required for operational and emergency voice communication from the offshore installation to the onshore control room and the emergency response centre locations. The equipment is normally supplied so that each outstation can selectively call each of the other outstations on the system. An 'All Call' facility is also normally provided so a call can be initiated to all outstations simultaneously. A direct speech channel is provided so that a 'party line' type circuit is available which can enable all outstations on lifting the telephone handset to monitor and access the channel on a full conference facility basis.

These circuits are normally presented as two wire, 600 ohm interfaces, however, in order to reduce cross-talk problems on multi-outstation systems which traverse many radio links and bridge unit drop-offs, four wire circuits and four wire telephones are used. The outstation equipment normally uses Dual Tone Multi-frequency (DTMF) telephones. As on normal telephone systems, each hotline system would provide ringing current to the called telephone and ringing tone back to the caller when there is an incoming call. Cancellation of ringing should occur when the handset of the called station is lifted.

Where dual communications channels are provided the hotline telephone system should select the best route without producing 'howl-round'. The best route may be manually selectable or automatic.



The hotline telephone system equipment should be compatible with any existing system at the onshore control centre and be powered from an ups.

See BP Group [RP 59-6](#) for further details of telecommunication power supplies

8. PLANNING AND PROCUREMENT

The following activities should be considered during the early planning and design.

(a) Statement of Requirements and Design

A statement of requirements should be drawn up which clearly states the telecommunication network needs. An outline specification for the overall telecommunication network requirements should be produced.

A definition of the network communication facilities required as outlined in section 3.1 of this Recommended Practice can be used to produce the SOR. This should be followed with an outline specification of the network based on details given in section 3.2, 4, 5, 6 and 7. See BP Group [RP 59-11](#) for details of design practices to be followed and BP Group [RP 59-7](#) for details of electromagnetic compatibility requirements to be taken into account during design.

(b) Mandatory or Regulatory Requirements

Radio frequency licence requirements and telecommunication administration equipment and operating approval needs should be discussed with the regulatory authority very early in the planning stage. Any constraints should be incorporated in the telecommunications system planning.

Outline proposals showing the main network elements should be sent and possibly discussed with the radio and equipment regulatory authorities. Radio link calculations and predictions will need to be sent to the radio regulatory licensing authority with the appropriate application forms.

(c) Radio Propagation and Antenna Location Considerations

It will probably be necessary to interconnect to existing offshore installation or to onshore locations and radio satellites using radio links, and detailed radio propagation calculations will need to be completed in order to confirm that the performance requirements can be achieved. Any changes to system design can then be incorporated at an early stage without incurring large costs

As explained in sections 4.2.2 and 4.3.1 the relative positions of the various support vessels with respect to the installation should be investigated at an early stage to ensure that there will be a clear line of site for any antenna beams and the various structures located offshore will not block radio propagation. Heat shields should be fitted when antenna assemblies are mounted close to flares.



(d) Equipment Location and Accommodation

Adequate provision should be made during the early design of the installation for space for the various equipment cabinets. Two primary locations will be required that are adequately separated and isolated to meet the reliability and safety requirements for the dual emergency communication facilities. All locations should have suitable facilities for cabling, power supply distribution and earthing.

Provision should be made within the architectural design of the installation for two independent telecommunication equipment rooms. The equipment rooms should be allocated as the main and back-up locations for any network communications equipment. One location would house all the common equipment. Other locations may also be required for telecommunication network equipment that is distributed around the installation. See BP Group [RP 59-11](#) for details of design and installation requirements.

(e) Suppliers and Vendors.

It will be necessary at an early stage to determine which vendors are capable and willing to carry out the detailed design, supply, installation, commissioning and possible maintenance for all the telecommunication network systems

It should be possible to have one vendor/contractor to complete the entire scope of work for the complete network requirements including installation and commissioning, and any necessary sub-division of equipment supply amongst various manufacturers should be handled by the main telecommunications network systems contractor. As a basic principle, the use of unproven suppliers should be avoided if at all possible. Suppliers should only be used where they have a proven track record for such projects and where they have internal organisation geared to rapid response situations.

(f) Specification of standard and well proven equipment

Equipment should be specified to have been proven in a similar application. Rugged construction, reliability, maintainability and climatic durability are factors which should receive particular attention. See BP Group [RP 59-11](#).

The following general planning concepts should be adopted:-

(a) A single point of contact should be appointed to be in direct control for managing the implementation

There are likely to be many contractors, suppliers and vendors involved in the implementation of the telecommunication systems for an offshore manned fixed installation and the network systems are only one aspect. In order to co ordinate the interfaces between the various systems a single point of contact is required. There is also a need to liaise with existing company network suppliers/maintainers, telecommunication regulatory administrations, and any onshore contractors. Only by the use of a company or company nominated technical telecommunications representative managing the implementation can success be assured. A full time supervisor of the activities involved is necessary to co-ordinate the various tasks and to have the necessary authority for the co-ordination and negotiations that are needed.



(b) Testing and Documentation Requirements

Design and procurement documentation should be completed at an early stage. See BP Group [RP 59-11](#) for details of testing and documentation requirements.

(c) Implementation and Installation

Implementation should rely on close co-operation with the selected vendor for meeting the technical performance and timescales required. The selected contractor should provide all the necessary skills, commissioning spares, consumables and test equipment required to complete the implementation within the required timescales.

A team of personnel dedicated to the contract should be nominated by the contractor. The contractor should hold regular meetings with the purchaser and issue monthly reports on progress against an agreed programme.

A full set of spares needed for commissioning would normally be included within the supply contract, however, the contractor should confirm that spare parts can be obtained within twenty-four hours from the relevant manufacturer or that they are held by the contractor as stock. Any items not available within twenty-four hours should be purchased and held by the contractor.

See BP Group [RP 59-11](#) for details of installation practices to be used. See BP Group [RP 59-7](#) for guidelines on electromagnetic compatibility during installation.

9. OPERATION AND MAINTENANCE

During operation, the various telecommunication systems on the installation will need to be maintained and the various telecommunications contractors will need to be supervised and coordinated. This activity will need to be carried out by an appointed member of staff offshore on the installation.

It is likely that this function could be handled by a full time telecommunications technician on the installation together with support from the onshore company network providers and with overall supervision being handled by the main installation lead engineer.

Systems should be specified to include equipment for automatic diagnosis, supervision and display of minor and major faults that develop and only minimum routine maintenance should be required. However, a set of routine maintenance testing and alignment procedures may need to be developed for certain equipment according to manufacturers recommendations. These procedures should also identify resources, schedules and necessary test equipment requirements.

Manufacturers and vendors supplying the original systems should be requested to supply any necessary routine maintenance procedures as part of the main equipment supply, installation and commissioning contract. Generally, test procedures will be according to manufacturer's



recommendations, and should comply with CCIR and CCITT recommendations. CCITT M and O series should be referred to for guidance.

A set of maintenance call-out and fault reporting procedures will need to be developed that also identify central locations for assistance with communication failures and breakdowns.

The centre for fault reporting tends to be the company's onshore help desk, however, in the first instance, all faults or complaints regarding service from the installation should be handled by the offshore telecommunications technician. Maintenance call-out requirements should be included in any contract details that are drawn up for equipment maintenance.

Adequate test equipment should be provided to carry out the routine preventative maintenance procedures and for fault finding.

The vendor supplying the original telecommunication systems should be requested to provide any necessary special-to-type test equipment or special tools as part of the main equipment supply, installation and commissioning contract. Any special test equipment would normally be manufactured by the equipment supplier and would be specifically designed to carry out tests on a particular units/sub-system, e.g. extension boards, cards, connecting lead and adapters etc., that are required to give access to components when a sub-unit is being tested as part of a working rack and to interface the test equipment to the units to be tested.

The maintenance philosophy should be to replace faulty equipment modules and sub-units offshore, and then return to the manufacturer for repair. A minimum quantity of one spare unit should be provided offshore for all items of hardware where standby units are not already available in the equipment supplied. The quantity and type of spare parts provided should be based on the expected reliability of each item and the required ordering periods.

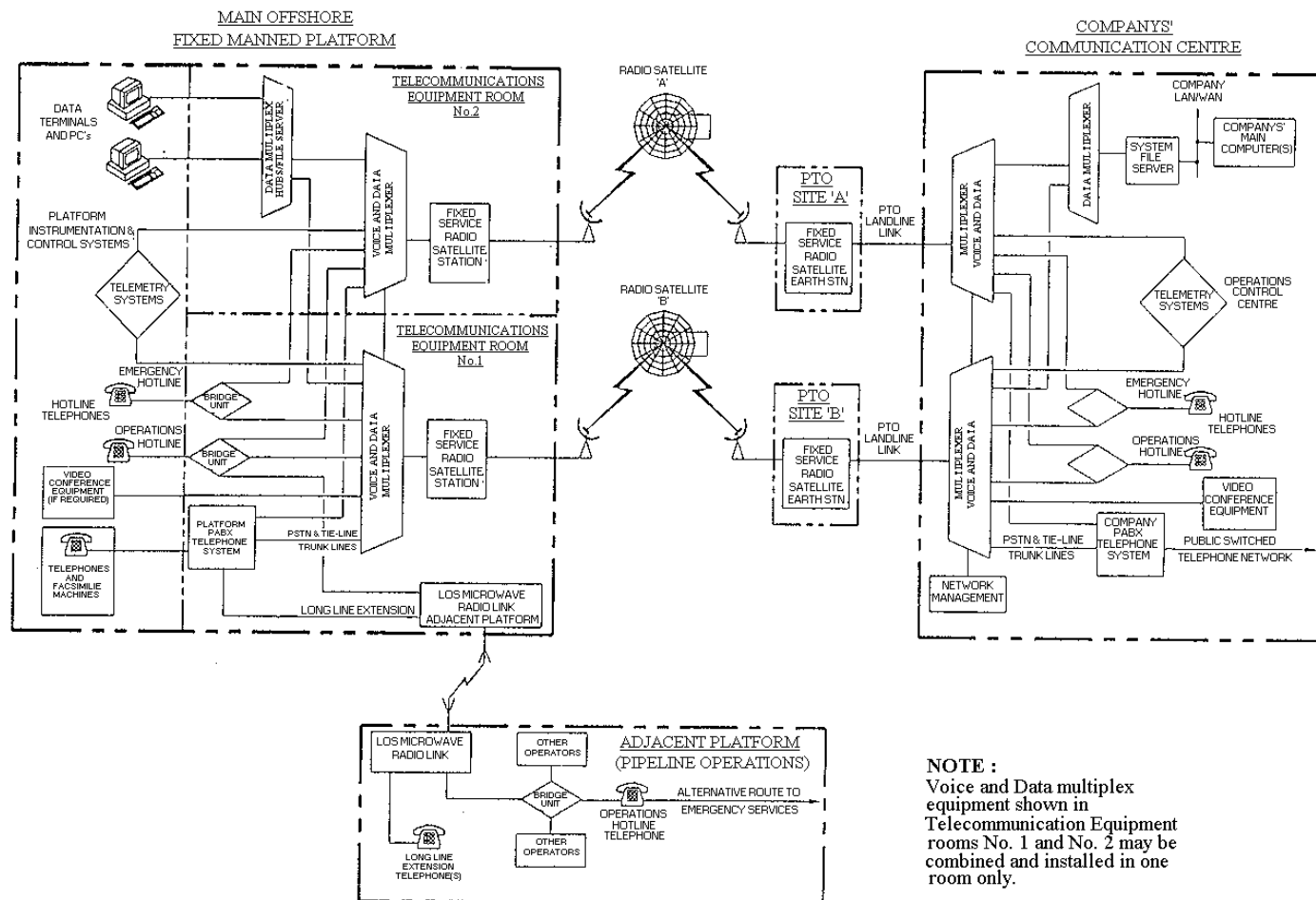
Sufficient skills and test equipment should be available to carry out first and second level maintenance, and the resources should be available offshore. The holding of component spares should be minimal and components should only be provided where fault diagnosis to component level is possible. Spare parts should be available from suppliers for a period of not less than ten years from the date of installation. MTBF's should be stated for all equipment and the availabilities should be calculated based on a minimum MTTR of four hours, assuming that spare parts will be available offshore. In addition, spare parts should be provided for items on long delivery that would not normally fail, but whose breakdown could cause a catastrophic system failure.





TYPICAL TELECOMMUNICATIONS NETWORK BLOCK DIAGRAM

FIGURE 1



NOTE :
Voice and Data multiplex
equipment shown in
Telecommunication Equipment
rooms No. 1 and No. 2 may be
combined and installed in one
room only.

DEFINITIONS AND ABBREVIATIONS

Definitions

Standardised definitions may be found in the BP Group RPSEs Introductory Volume.

Abbreviations

AC	Alternating Current
AH	Ampere Hour
APNSS	Analogue Private Network Signalling System
ASCII	American Standard Code for Information Interchange
AUI	Attachment Unit Interface (Data Communications connector interface between the Ethernet/IEEE 802.3 controller and the baseband transceiver or modem)
BABT	British Approval Board for Telecommunications
BER	Bit Error Rate
BTNR	British Telecom Network Requirement
CEPT	Committee for European Posts and Telecommunications
CCIR	International Committee for Radio Recommendations
CCITT	International Committee for Telephony and Telegraphy Recommendations
CT2	Cordless Telephone system No. 2
CTS	Clear to Send (from EIA RS 232)
dB(p)	Decibel (psophometrically weighted)
DC	Direct Current
DCE	Data Communications Equipment
DCS	Distributed Control System
DCT	Data Circuit Terminating equipment
DECT	Digital European Cordless Telecommunications
DID	Direct Inward Dialling
DPNSS	Digital Private Network Signalling System
DTI	Department of Trade and Industry
DTMF	Dual Tone Multi-Frequency
DTR	Data Set Ready (from EIA RS 232)
E&M	'Ear' and 'Mouth'- an out of band signalling system used over radio links
ESD	Emergency Shutdown
ETSI	European Telecommunications Standards Institute
Eutelsat	European Telecommunications Satellite Organisation.
Ex(d)	Flameproof enclosure in accordance with BS 5501 part 5 and BS 5345
FAX	Facsimile
FDM	Frequency Division Multiplex
GHZ	1 GHz = 1000 MHz
HPA	High Power Amplifier



HF	High Frequency (3 MHz to 30 MHz)
ID	Identification Dialling Code
IEE	Institution of Electrical Engineers
IEEE	Institution of Electrical and Electronic Engineers (USA)
Inmarsat	International Maritime Satellite Organisation
IS	Intrinsically Safe in accordance with BS 5501 part 7 and BS 5345
ISO	International Standards Organisation
Intelsat	International Telecommunications Satellite Organisation
kB/s	Kilo Bits per second 1 kB/s=1000 Bits per second (Data Transmission Rate)
kHz	1 kHz = 1000 Hz
LAN	Local Area Network
LNA	Low Noise Amplifier
MCL	Mercury Communications Limited
MDF	Main Distribution Frame
MF	Medium Frequency (300 kHz to 3 MHz)
MHz	1 MHz = 1000 kHz
MTTR	Mean Time To Repair
NBS	National Bureau of Standards (USA)
PA	Public Address system
PABX	Private Automatic Branch Exchange
PSTN	Public Switched Telephone Network
PTO	Public Telecommunications Organisation
SCADA	Supervisory Control and Data Acquisition System
SSAC15	Signalling System AC15 (see BTNR)
SSDC5	Signalling System DC5 (see BTNR)
TDM	Time Division Multiplex
UHF	Ultra High Frequency (300 MHz to 3000 MHz)
UPS	Uninterruptible Power Supply
VHF	Very High Frequency (30 MHz to 300 MHz)
Xon/Xoff	Characters used to control data transmission flow into data storage buffers



LIST OF REFERENCED DOCUMENTS

A reference invokes the latest published issue or amendment unless stated otherwise.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

The following are U.K. Regulations, Standards, Guides and Codes of Practice containing sections relevant to the design of Network Telecommunications Systems and should be referred to for the interpretation and application of this Recommended Practice:-

British Standards

- BS 5345:** *Code of Practice for the selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres (other than mining applications or explosive processing and manufacture) Part 1 Basic requirements for all parts of the code Part 2 Classification of hazardous areas*
- This is primarily concerned with the classification of hazardous areas and the selection of appropriately certified equipment for those areas.*
- BS 5501:** *Electrical apparatus for potentially explosive atmospheres Part 1 General requirements Part 5 Flameproof enclosures Part 7 Intrinsic Safety 'i'*
- This describes the requirements for equipment for use in hazardous areas.*
- BS 6204:** *Specification for safety of data processing equipment*
- BS 6301:** *Safety requirements for apparatus for connection to British Telecom networks.*
- BS 6450:** *Private branch exchanges for connection to the British Telecom PSTN.*
- BS 6656:** *Guide to Prevention of inadvertent ignition of flammable atmospheres by radiofrequency radiation Revised 1991.*

British Telecom Standards

- BTNR 181** *SSAC15 Signalling standards*
- BTNR 182** *SSDC5 Signalling standards*
- BTNR 188** *Parts 1-26: Digital private network signalling system.*
- BT/OTF 85/2** *Transmission standards for analogue terrestrial microwave relay links connecting offshore communication networks with British Telecom's public networks*
- RC 4030A** *Overall performance requirements and supervisory requirements for 72/132 telephone channel radio relay equipment for use in an offshore communication network operating in the band 1700-1900 MHz*



RC 4031A	Overall performance requirements and supervisory requirements for 12/24 telephone channel radio relay equipment for use in an offshore communication network operating in the band 1450-1530 MHz
RC 4032	Overall performance requirements and supervisory requirements for 8 telephone channel radio relay equipment for use in an offshore communication network operating in the band 1450-1535 MHz

CCIR Recommendations and Reports

RS (Volume IV-1)	Fixed satellite service
RPN (Volume V)	Propagation in non-ionised media
RF (Volume IX-1)	Fixed service using radio-relay systems

CCITT 1988 'Blue Book' Recommendations

Fascile II.5	Telematic, data transmission and teleconference services - operations and quality of service. (Rec. F160-F.730)
Fascile III.2	International analogue carrier systems. (Rec.G.211-G544)
Fascile III.4	General aspects of digital transmission systems; terminal equipments. (Rec. G.700-G.772)
Fascile III.5	Digital networks, digital sections and digital line systems. (Rec.G.801-G.956).
Fascile IV.1	General maintenance principles: maintenance of international transmission systems and telephone circuits (Rec.M.10-M.782)
Fascile IV.4	Specifications for measuring equipment. (Rec. O series)
Fascile V	Telephone transmission quality. (Rec. P series)
Fascile VI.1	General recommendations on telephone switching and signalling. Functions and information flows in the ISDN. (Rec Q.1-Q.118 bis)
Fascile VII.3	Terminal equipment and protocols for telematic services. (Rec. T.0-T.63)
Fascile VIII.1	Data communication over the telephone network. (Rec. V series)
Fascile VIII.2	Data communication networks: services and facilities, interfaces. (Rec. X.1-X.32)
Fascile VIII.3	Data communication networks: transmission, signalling and switching, network aspects, maintenance and administration arrangements. (Rec. X.40-X.181)

CCITT recommendations are no longer published as complete sets i.e fascicles, as shown above but as individual recommendations. A complete list of all up to date publications is available from Omnicom, Herts.

Department of Trade and Industry Radiocommunications Agency Specifications for Microwave Radio Links

MPT 1401	Single channel and 1+1 channel FDM 1450-1690 MHz radio links
MPT 1402	36 channel FDM-FM 1450-1530 MHz radio links
MPT 1403	34.368 MB/s Digital and 300 FDM-FM Analogue 12750-13250 MHz radio links
MPT 1404	1450-1690 MHz Antennas
MPT 1405	1700-1900 MHz Antennas
MPT 1406	12750-13250 MHz Antennas
MPT 1407	Frequency assignment criteria for 7425-7900 MHz radio links
MPT 1408	Eight channel FDM-FM 1450-1530 MHz radio links
MPT 1409	21200-23600 MHz radio links
MPT 1410	Digital auxiliary broadcast 1450-1530 MHz radio links sub-band G
MPT 1412	Digital 1450-1530 MHz sub-bands B and X radio links



MPT 1413	Analogue 7425-7900 MHz radio links
MPT 1414	Analogue and Digital 37000-39500 MHz radio links
MPT 1415	57200-58200 MHz radio links
MPT 1416	Digital 54250-57200 MHz radio links
MPT 1417	Digital 1450-1530 MHz sub-band D radio links
MPT 1418	Analogue TV, 7.5, 13, 14, 23, 38 and 55 GHz band radio links
MPT 1420	Analogue and Digital TV 27.5-29.5 GHz radio links
MPT 1421	Digital, 4, 6, 7, 8 and 13 GHz band radio links

Electrical Industries Association (USA)

EIA RS 222	Nominal twist and sway values for microwave tower and antenna systems
EIA RS 232	Interface between data terminal equipment and data communications equipment employing serial binary data interchange

European Telecommunications Standards Institute.

prETS 300 197	Digital and analogue 38 GHz band radio links
prETS 300 198	Digital and analogue 23 GHz band radio links
DE/TM-4005	Digital 4, 6, 7 & 8 GHz band radio links
DE/TM-4006	Digital and analogue 55 GHz band radio links
DE/TM-4010	Digital 13, 14 & 15 GHz band radio links
DE/TM-4011	Digital 18 GHz radio links
Unmarked	Digital 1.5 GHz radio links
prETS 300 237/238/239/240	Private telecommunications network
prTBR 006/prTBR 10	DECT

Eutelsat

BS7-40	Performance characteristics of earth stations accessing the Eutelsat space segment for business services
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ACO 1-18	ESVA test procedures for the ECS/SMS earth stations
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IEE Recommendations for the Electrical and Electronic Equipment of Mobile and Fixed Offshore Installations

A general design guide for electrical and electronic equipment on offshore applications.

Institution of Electrical and Electronic Engineers (USA)

IEEE 802.3	Carrier Sense Multiple access and Collision detection (CSMA/CD) access
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Intelsat

[Intelsat Earth Station Standard \(IESS\) 405](#), Intelsat V Satellite Characteristics
[Intelsat Earth Station Standard \(IESS\) 406](#), Intelsat VA Satellite Characteristics
[Intelsat Earth Station Standard \(IESS\) 407](#), Intelsat VA(IBS) Satellite Characteristics
[Intelsat Earth Station Standard \(IESS\) 408](#), Intelsat VI Satellite Characteristics
[Intelsat Earth Station Standard \(IESS\) 409](#), Intelsat VII Satellite Characteristics



International Standards Organisation

RJ11	Four core telephone and data connector
RJ45 (ISO 8877)	Eight core data connector (used in 10 Base T data wiring systems).

Mineral Workings (Offshore Installations) Act 1971

- (i) *Offshore Installations (Construction and Survey) Regulations 1974, SI 1974/289.*
- Prescribes the use of standards for the design and construction of offshore installations and includes requirements relating to equipment to be placed in hazardous areas.*
- (ii) *Offshore Installations: Guidance on Design and Construction - Department of Energy.*
- Includes guidance on matters relating to certification, emergency shutdown systems and emergency power supplies.*

National Bureau of Standards

The NBS is now the NIST i.e National Institute of Standards and Technology

NBS Technical Note 101	<i>Transmission loss predictions for tropospheric communication circuits.</i>
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BP Group Documents

BP Group RP 59-1	<i>Telecommunication - emergency Shutdown System.</i>
BP Group RP 59-3	<i>Selection of Shipping and Aeronautical Communication for Manned Offshore Fixed Installations.</i>
BP Group RP 59-4	<i>Selection of On-platform Communication for manned Offshore Fixed Installations.</i>
BP Group RP 59-5	<i>Selection of Emergency Communication for Manned Offshore Fixed installations.</i>
BP Group RP 59-6	<i>Selection of Telecommunication Power Supplies for Manned Offshore Fixed Installations.</i>
BP Group RP 59-7	<i>Electromagnetic Compatibility for manned Offshore Fixed Installations.</i>
BP Group RP 59-8	<i>Selection and use of Temporary Telecommunication for Offshore installation Projects.</i>
BP Group RP 59-11	<i>Design and Installation Practice for Telecommunication systems on Manned Offshore Fixed Installations.</i>

