NICC Document   ND1130:2001/05

ND1130:2001/05

USER NETWORK INTERFACE
BASED UPON PERMANENT ATM
CONNECTIONS

TECHNICAL RECOMMENDATION

Issue 3

Normative Information

0.1   Contents

0.2 History

Revision	Date of Issue	Updated By	Description
Issue 1.0	January 1998	A McBain	Agreed for release to the PNO-IG steering committee
Issue 1.1	February 1998	A McBain	Corrigendum agreed for release to PNO-IG steering committee with new informative text for Section 3.3 on PRNG reset.
Issue 2.0	October 1999	A McBain	25,600 kbit/s interface revised (section 3.3) editorial corrections
Issue 2.1	January 2000	A McBain /H C Taylor	Incorporates comments from PNO ATM review
Issue 3	May 2001	A. Martin	Update type approval section (for RTTE directive) and the inclusion of Universal Serial Bus (USB), Inverse Multiplexing (IMA) and SDH STM-4 physical characteristics. Other technical/editorial changes

0.3 Issue Control

SECTION	ISSUE	DATE
All	Issue 3	10th May 2001

0.4 References

[1] PNO-IG/ATM/TG/ CP(98)12 (10/98) ATM Access and Interconnect between UK Licensed Operators - Overview Recommendation Issue 2.0

[2] ITU-T Recommendation I.113 - "Vocabulary of Terms for Broadband Aspects of ISDN", Revision 2, November 1993.

[3] "User-Network Interface (UNI) Specification Version 3.1". The ATM Forum Technical Committee, September 1994.

[4] ITU-T Recommendation G.703 - "Physical/electrical characteristics of hierarchical digital interfaces", April 1991.

[5] ITU-T Recommendation G.821 - "Error performance in an international digital connection operating at a bit rate below the primary rate and forming part of an Integrated Services Digital Network", August 1996.

[6] ITU-T Recommendation G.823 - "The control of Jitter and Wander within Digital Networks which are based on the 2,048 kbit/s Hierarchy", March 1993.

[7] ITU-T Recommendation I.432.3 - "B-ISDN user-network interface - Physical layer specification: 1544 kbit/s and 2048 kbit/s operation", February 1999

[8] ITU-T Recommendation G.704 - "Synchronous frame structure used at 1544, 6312, 2048, 8488 and 44736 kbit/s hierarchical levels", 1988.

[9] ITU-T Recommendation G.706 - "Frame alignment and Cyclic Redundancy Check (CRC) procedures relating to basic frame structures defined in Recommendation G.704", 1988.

SEE PAGE 2 FOR THE NORMATIVE INFORMATION

[10]   ITU-T Recommendation G.732 - "Characteristics of Primary PCM Multiplex Equipment operating at 2048 kbit/s", 1988.

[11]   ITU-T Recommendation G.804 - "ATM Cell Mapping into Plesiochronous Digital Hierarchy (PDH)", November 1993.

[12]   BNC Connector complying with figure 2 of BS 9210 N0001:Part 2:1982.

[13]   EN 28877 - "Interface connector and contact assignments for ISDN basic access interface located at reference points S and T", September 1993.

[14]   ETSI I-ETS 300 811 - "Transmission and Multiplexing (TM); Broadband Integrated Services Digital Network (B-ISDN); Transmission Convergence (TC) and Physical Media Dependent (PMD) sublayers for the S_B reference point at a bit-rate of 25.6 Mbit/s over twisted pair cable", February 1998.

[15]   BS EN 60603-7 - "Detail specification for connectors, 8-way, including fixed and free connectors with common mating features", 1993.

[16]   ITU-T Recommendation G.832 - "Transport of SDH elements on PDH networks: Frame and multiplexing structures", November 1993.

[17]   ITU-T Recommendation I.432.2 - "B-ISDN user-network interface - Physical layer specification: 155 550 kbit/s and 622 080 kbit/s operation", March 1999.

[18]   ITU-T Recommendation G.707 - Network node interface for the synchronous digital hierarchy (SDH) March 1996.

[19]   ETSI Standard ETS 300 166 - "Transmission and multiplexing: Physical/electrical characteristics of hierarchical digital interfaces for equipment using the 2048 kbit/s based Plesiochronous synchronous digital hierarchies", 1993.

[20]   ITU-T Recommendation G.957 - "Optical interfaces for equipments and systems relating to the synchronous digital hierarchy", July 1995.

[21]   BS EN 60825-1:1994 "Safety of Laser Products Part 1 Equipment classification".

[22]   BS EN 60825-2:1995 "Safety of Laser Products Part 2 Safety of Optical fibre communications systems".

[23]   ITU-T Recommendation G.652 - "Characteristics of a single-mode optical fibre cable", March 1993.

[24]   BS EN 186110:1994. "Sectional Specification. Connector sets for optical fibre and cables Type FC", 1994.

[25]   ITU-T Recommendation I.150 - "B-ISDN Asynchronous Transfer Mode Functional Characteristics", November 1995.

[26]   ITU-T Recommendation I.361 - "B-ISDN ATM layer specification", November 1995.

[27]   ITU-T Recommendation I.432.1 - "B-ISDN user-network interface - Physical layer specification: General characteristics", February 1999.

[28]   ANSI T1.102 - "Telecommunications - Digital Hierarchy - Electrical Interfaces", 1993

[29]   ITU-T Recommendation G.811, "Digital transmission systems – Digital networks – Design objectives for digital networks

[30]   Universal Serial Bus Specification   Revision 2.0

         http://www.usb.org/

[31]   Universal Serial Bus Class Definitions for Communication Devices Revision 1.1 Jan 1999

         http://www.usb.org/

[32]   ATM Forum signalling specification 'Inverse Multiplexing for ATM (IMA) Specification Version 1.0 AF-PHY-0086.000'

[33]   ATM Forum Signalling specification Inverse Multiplexing for ATM (IMA) Specification Version 1.1 AF-PHY-0086.001

SEE PAGE 2 FOR THE NORMATIVE INFORMATION

0.5   Glossary of terms

0.5.1   Abbreviations

ATM	Asynchronous Transfer Mode
ANSI	American National Standards Institute
BABT	British Approvals Board for Telecommunications
B-ISDN	Broadband Integrated Services Digital Network
BNC	Bayonet Neill Cancelman
BS EN	British Standard European Norm
B3ZS	Bipolar with three-Zero Substitution
CBR	Constant Bit Rate
CDVt	Cell Delay Variation tolerance
CLP	Cell Loss Priority
CMI	Coded Mark Inversion
CPE	Customer Premise Equipment (Previously known as Terminal Equipment)
FC	Face Contact
HDB3	High Density Bipolar of order 3
HEC	Header Error Check
ILMI	Integrated Local Management Interface
MBS	Maximum Burst Size
NRZ	Non-Return to Zero
NTE	Network Termination Equipment
NTP	Network Termination Point
OAM	Operations And Maintenance
PLCP	Physical Layer Convergence Protocol
PCR	Peak Cell Rate
PDH	Plesiochronous Digital Hierarchy
PRNG	Pseudo Random Number Generator
PT	Payload Type
PVC	Permanent Virtual Connection
PVP	Permanent Virtual Path
SCR	Sustainable Cell Rate
SDH	Synchronous Digital Hierarchy
STM-1	Synchronous Transfer Mode 1
STM-4	Synchronous Transfer Mode 4
SVC	Switched Virtual Connection
TE	Terminal Equipment

TIA/EIA	Telecommunications Industry Association/Electronic Industries Association
UNI	User Network Interface
USB	Universal Serial Bus
UTP	Unshielded Twisted Pair
VBR-nrt	Variable Bit Rate - non real time
VC	Virtual Channel
VC4-4c	Virtual Container 4 concatenated
VCC	Virtual Channel Connection
VCI	Virtual Channel Identifier
VP	Virtual Path
VPC	Virtual Path Connection
VPI	Virtual Path Identifier

0.5.2   Definitions

asynchronous transfer mode (ATM)

A transfer mode in which the information is transferred within labelled cells; it is asynchronous in the sense that the recurrence of cells containing information from an individual user is not necessarily periodic.

ATM traffic descriptor

A generic list of traffic parameters that can be used to capture the intrinsic traffic characteristics of an ATM connection.

cell

A block of fixed length which is identified by a label at the asynchronous transfer mode layer of the B-ISDN protocol reference model.

cell header

The bits within a cell allocated for functions required to transfer the cell payload within the network.

congestion

A set of one or more network elements in which the network is not able to meet the negotiated QoS objective for the already established connections and for the new connection requests.

congestion control

The set of actions taken to relieve congestion by limiting the spread and duration of it.

connection admission control (CAC)

The set of actions taken by the network at the call set-up phase (or during call re-negotiation phase) in order to establish whether a virtual channel/virtual path connection can be accepted or rejected (or a request for re-allocation can be accommodated). Routing is part of connection admission control actions.

constant bit rate (CBR)

A type of telecommunication service characterised by a service bit rate specified by a constant value.

generic flow control (GFC)

A 4 bit field in the ATM cell header intended to support multiplexing functions.

header error check (HEC)

A single octet field within the ATM cell header used for header bit-error detection and correction.

idle cells

ATM cells that do not contain any user information, but which are used by the ATM physical layer in order to adjust or maintain the cell transmission rate.

SEE PAGE 2 FOR THE NORMATIVE INFORMATION

network node interface (NNI)

The interface at a network node which is used to interconnect with another network node.

OAM cell

An ATM cell that carries OAM information for the performing of specific OAM functions. The term maintenance cell is often used as a synonym for OAM cell.

physical layer convergence protocol (PLCP)

A protocol that specifies the mapping of ATM cells to PDH frames.

synchronous transfer mode (STM)

A transfer mode which offers periodically to each connection a fixed-length word.

traffic contract

The requested QoS for any given ATM connection and the maximum cell delay variation tolerance allocated to the customer equipment.

traffic control

The set of actions taken by the network in all relevant network elements to avoid congestion conditions.

transmission path

The whole of the means of transmitting and receiving a digital signal of specified rate between two digital distribution frames (or equivalent) at which terminal equipment or switches will be connected. Terminal equipment are those at which the signal originates or terminates. A transmission path is connected through one or more digital sections.

usage parameter control (UPC)

The set of actions taken by the network to monitor and control traffic at the user network interface, to protect network resources from malicious as well as unintentional misbehaviour by detecting violations of negotiated parameters and taking appropriate actions.

unshielded twisted pair

A form of cable that is used to interconnect cable consisting of two wires which are twisted together.

user network interface (UNI)

The interface between a network and a user's terminal equipment, identified by the ITU-T reference point (S/T).

variable bit rate (VBR)

A type of telecommunication service characterised by a service bit rate specified by statistically expressed parameters which allow the bit rate to vary within defined limits.

SEE PAGE 2 FOR THE NORMATIVE INFORMATION

virtual channel (VC)

A concept used to describe the transport of ATM cells associated by a common unique identifier value called VCI.

virtual channel link

A means of transport of ATM cells between a point where a virtual channel identifier value is assigned and the point where that value is translated or removed.

virtual channel connection (VCC)

A concatenation of virtual channel links that extends between two points where the adaptation layer is accessed.

virtual path (VP)

A concept used to describe the transport of ATM cells belonging to virtual channels that are associated by a common identifier value called VPI.

virtual path link

The group of virtual channel links, identified by a common value of the virtual path identifier, between the point where the VPI value is assigned and the point where the VPI value is translated or removed.

virtual path connection (VPC)

A concatenation of virtual path links that extends between the point where the virtual channel identifier values are assigned and the point where those values are translated or removed.

0.6   Scope

This ATM technical recommendation defines the transport of ATM cells across an UNI, supported by a number of different physical layer specifications. It supports Permanent Virtual Connection (PVC) connectivity, consisting of either one of more Virtual Channel Connections (VCC) or Virtual Path Connections (VPC) between two ATM end-points on a point to point basis.

This ATM UNI technical recommendation conforms to the ATM Forum, User Network Interface specification (UNI) Version 3.1 [3], except for the support of signalling for Switched Virtual Connections (SVC), point-to-multipoint VPC/VCCs and the Integrated Local Management Interface (ILMI), which are not supported.

For the purposes of this document, the ATM UNI is equivalent to the Network Termination Point (NTP), i.e. the point of connection between the service network and the CPE.

While this recommendation defines a range of interface types, it is important to note that a particular network may not support all of the variants listed here in.

Certain aspects are not recommended since there are areas where Network Operators may wish to offer unique services.

1   Introduction

This recommendation is intended to facilitate terminal portability between UK licensed operators' public ATM networks. It addresses the user interface to these networks, employing permanent ATM connections. Interfaces are recommended for connecting users to ATM networks based on ITU-T recommendations, ETSI and ANSI standards, and ATM Forum specifications. Where details of ATM related interfaces are not covered in this recommendation, reference shall be made to the appropriate ITU-T recommendations and/or ETSI standards. The long-term objective is to migrate to ETSI standards when the individual standards become available and sufficiently mature.

Information on Interconnect Topologies and Virtual Connection Configurations are described in Sections 7 and 8 of "ATM Access and Interconnect between UK Licensed Operators (Overview)" [1].

Definitions of B-ISDN terms used within this document can be found in ITU-T Recommendation I.113 [2].

SEE PAGE 2 FOR THE NORMATIVE INFORMATION

2   Physical Layer Characteristics of the UNI

2.1   2,048 kbit/s Interface (75 ohm)

This interface supports access at 2,048 kbit/s which conforms to;

ITU-T Recommendation G.703 [4] for physical characteristics,
ITU-T Recommendation G.821 [5] for physical characteristics,
ITU-T Recommendation G.823 [6] for physical characteristics,
ITU-T Recommendation I.432.3 [7] for physical characteristics,
ITU-T Recommendation G.704 [8] for frame structure,
ITU-T Recommendation G.706 [9] for frame structure,
ITU-T Recommendation G.732 [10] for frame structure,
ITU-T Recommendation G.804 [11] for ATM cell mapping.

The physical interface is presented on two 75 ohm female BNC coaxial connectors [11].

HDB3 line coding is used.

2.2   2,048 kbit/s Interface (120 ohm)

This interface supports access at 2,048 kbit/s which conforms to;

ITU-T Recommendation G.703 [4] for physical characteristics,
ITU-T Recommendation G.821 [5] for physical characteristics,
ITU-T Recommendation G.823 [6] for physical characteristics,
ITU-T Recommendation I.432.3 [7] for physical characteristics,
ITU-T Recommendation G.704 [8] for frame structure,
ITU-T Recommendation G.706 [9] for frame structure,
ITU-T Recommendation G.732 [10] for frame structure,
ITU-T Recommendation G.804 [11] for ATM cell mapping.

The physical interface is presented on a connector conforming to EN 28877 [13].

HDB3 line coding is used.

2.3   IMA over N x 2,048 Kbit/s Interface (Inverse Multiplexing)

This interface supports N x 2,048 Kbit/s interface as defined by 2.1 and 2.2. The protocol used to associate these interfaces is as defined in ATM-Forum signalling specifications;

Inverse Multiplexing for ATM (IMA) Specification Version 1.0 AF-PHY-0086.000 [31] or Inverse Multiplexing for ATM (IMA) Specification Version 1.1 AF-PHY-0086.001 [32].

As a minimum, an implementation should be complaint with the mandatory requirements of the implemented specification.

The value of N is a customer option, up to a maximum value of 8.

2.4   25,600 kbit/s Interface (100 ohm)

This interface supports access at 25,600 kbit/s over a twisted pair which conforms to;

ETSI I-ETS 300 811 [14]

The following options have been chosen from within the standard:-

1. The 100 Ohm Copper Unshielded Twisted Pair (UTP) option will be used with a BS EN 60603-7:1993 (RJ-45 type) [15] connector.

2. Support for a Timing Signal: Support of the Sync_Event command symbol-pair, X_8, as defined in [14] shall be optional. If this capability is implemented then, whenever a Sync_Event command is detected by the receiver, the Sync_Event command need not be 'wrapped around' and transmitted onto the upstream path.

SEE PAGE 2 FOR THE NORMATIVE INFORMATION

3. Cell Scrambling and Descrambling shall implement a minimum time between PRNG reset of 200 microseconds & not 100 microseconds as specified in I-ETS 300 811 [14]. The choice of 200 microseconds reflects the current technology constraints that were not appreciated at the time of drafting this standard. This interim standard is currently subject to revision changes to reflect this.

2.5 PDH 34,368 kbit/s Interface

This interface supports PDH access at 34,368 kbit/s which conforms to;

> ITU-T Recommendation G.703 [4] for physical characteristics,
> ITU-T Recommendation G.832 [16] for frame structure,
> ITU-T Recommendation G.804 [11] for ATM cell mapping.

The physical interface is presented on two 75 ohm female BNC coaxial connectors [12].

HDB3 line coding is used.

2.6 PDH 45,736 kbit/s Interface

This interface supports PDH access at 45,736 kbit/s which conforms to either;

> ITU-T Recommendation G.703 [4] for physical characteristics,
> or
> ANSI T1.102 [28]
>
> and to;
>
> ITU-T Recommendation G.832 [16] for frame structure,
> ITU-T Recommendation G.804 [17] for ATM cell mapping.

Both PLCP-based mapping and HEC-based mapping are supported.

The physical interface is presented on two 75 ohm female BNC coaxial connectors [12].

B3ZS line coding is used.

2.7 SDH (STM-1) 155,520 kbit/s (Multi Mode Optical) Interface

This interface supports SDH access at 155,520 kbit/s which conforms to;

> ITU-T Recommendation I.432.2 [17] for physical characteristics,
> ITU-T Recommendation G.707 [18]for the NNI for SDH,

Timing at the Interface will be in accordance with ITU-T Recommendation G.811 *[29]*.

The physical interface is presented on a Dual SC (Snap Connection) connector.

2.8 SDH (STM-1) 155,520 kbit/s (Electrical) Interface

This interface supports SDH access at 155,520 kbit/s which conforms to;

> ITU-T Recommendation I.432.2 [17] for physical characteristics,
> ITU-T Recommendation G.703 [4] for physical characteristics,
> ITU-T Recommendation G.707 [18] for the NNI for SDH,

Timing at the Interface will be in accordance with ITU-T Recommendation G.811 *[29]*.

The physical interface is presented on two 75 ohm female BNC coaxial connectors [12].

CMI line coding in accordance with ETS 300166 [19] is used.

2.9   SDH (STM-1) 155,520 kbit/s (Single Mode Optical) Interface

This interface supports SDH access at 155,520 kbit/s which conforms to;

ITU-T Recommendation I.432.2 [17] for physical characteristics,
ITU-T Recommendation G.707 [18] for bit rates,

This is presented as an optical Single mode fibre connection and uses the Non Return to Zero (NRZ) line coding conforming to ITU-T Recommendation G.957 [20] for SDH optical requirements. The optical fibre presentation at the UNI is conformant to BS EN 60825-1 [21] and BS EN 60825-2 [22] as a Class 1 Laser Product.

The interface operates over single mode optical fibre conforming to ITU-T Recommendation G.652 [23] and presents a SDH based frame structure as defined in ITU-T Recommendation I.432.2 [17] for the ATM UNI physical layer.

The optical connector is FC type conforming to BS EN 186110:1994 [24]. The connector is Physical Contact (PC) polished.

Timing at the Interface will be in accordance with ITU-T Recommendation G.811 *[29]*.

2.10 SDH (STM-4) 622 080kbit/s (Single Mode Interface) Interface (STM-4 (VC4-4c))

This is presented as an optical Single mode fibre connection conforming to ITU-T Recommendation G.957 [20] for SDH optical requirements. The optical fibre presentation at the UNI is conformant to BS EN 60825-1 [21] and BS EN 60825-2 [22] as a class 1 Laser Product.

The physical presentation is via a FC type optical connector conforming to BS EN 186110:1994 [24]. The connector is Physical Contact (PC) polished. Non Return to Zero line coding is used as specified in ITU-T Recommendation G.957 [20].

The signal transmitted from the BT NTE is derived from the 1310nm wavelength short haul SDH class (S-4.1 as specified in ITU-T Recommendation G.957 [20]) optical transmitter. The NTE receiver power range is between –10dBm and –34dBm.

2.11 Universal Serial Bus (USB) Interface

The following characteristics apply to the USB Interface as described in the USB Specification Revision 2.0Ref. [30].

The USB Interface shall:

- Use a standard Type A USB plug connector.

- Require up to 500mA @ 5V to be provided over the bus.

3   ATM Characteristics of the UNI

3.1   ATM Connection Types

The types of permanent ATM connections supported are:

- Permanent Virtual Channels (PVCs)
- Permanent Virtual Paths (PVPs)

SEE PAGE 2 FOR THE NORMATIVE INFORMATION

The QoS performance values of a PVP connection shall meet the most demanding QoS performance values of a PVC connection carried within that PVP connection, as defined in ITU-T Recommendation I.150 [25].

3.2 Connection Topology Types

Only point-to-point (both uni-directional and bi-directional) ATM connections are supported. Point-to-multipoint connections are not supported.

3.3 Cell Header Functions

The interface will support ATM cells conforming to the cell structure defined in the ATM Forum UNI Version 3.1 [3] and in ITU-T Recommendation I.361 [26]. The functionality that is supported within the cell header is listed below.

3.3.1 Virtual Path Identifier (VPI) and Virtual Channel Identifier (VCI)

There may be restrictions placed by the Network Operator on the range of Virtual Path Identifier (VPI) and Virtual Channel Identifier (VCI) values that can be supported on an interface, over and above the pre-assigned VPI and VCI values defined in ITU-T Recommendation I.361 [26].

3.3.2 Cell Loss Priority (CLP)

The ATM UNI is defined for the user sending cells with Cell Loss Priority (CLP) bit set to CLP=0. If the user chooses to send cells with CLP=1, then performance objectives for the service may not be met and CLP=1 cells may be selectively discarded.

3.3.3 Payload Type Indicator (PTI)

The Payload Type Indicator (PTI) shall be coded in accordance with ITU-T Recommendation I.361 [26].

3.3.4 Generic Flow Control (GFC)

The procedures relating to GFC are not supported and the GFC field shall be encoded to all zeros (0000).

3.3.5 Header Error Check (HEC)

The ATM Header Error Check (HEC) shall be in accordance with the ITU-T Recommendation I.432.1 [27]. Single bit error correction shall be enabled.

3.4 Payload Scrambling

ATM Cell Payload scrambling/descrambling shall be in accordance with the ITU-T Recommendation I.432.1 [27].

3.5 Cell Rate Decoupling

Both idle and unassigned cells are accepted at network ingress (terminal to network direction) for cell rate decoupling, but only idle cells are used on network egress (network to terminal direction).

3.6 ATM Service Categories

No Recommendation

3.7 Quality of Service

No Recommendation

SEE PAGE 2 FOR THE NORMATIVE INFORMATION

3.8   ATM Layer Management Specification (M-Plane)

Fully Compliant with ATM Forum UNI V3.1 [3], with the exception that the support of Operations And Maintenance (OAM) F4 and F5 segment and end-to-end cells are optional.

3.9   Traffic Control and Congestion Control

The Traffic Control and Congestion Control for;

3.9.1   Source traffic Descriptor / traffic contract

Complies as defined in ATM-F User-Network Interface (UNI) Specification Version 3.1 [3].

3.9.2   Connection Admission Control

Complies as defined in ATM-F User-Network Interface (UNI) Specification Version 3.1 [3].

3.9.3   Usage Parameter Control

Complies as defined in ATM-F User-Network Interface (UNI) Specification Version 3.1 [3].

3.9.4   Selective Cell Discarding

Complies as defined in ATM-F User-Network Interface (UNI) Specification Version 3.1 [3].

3.9.5   Traffic Shaping

Complies as defined in ATM-F User-Network Interface (UNI) Specification Version 3.1 [3].

3.9.6   Explicit Forward Congestion Indication

Complies as defined in ATM-F User-Network Interface (UNI) Specification Version 3.1 [3].

3.9.7   Overbooking

Overbooking on an interface VP/VC and/or service category basis may be supported with bilateral agreement

3.10 Integrated Local Management Interface

 The ILMI procedures as defined in [3] section 4 are not supported.

3.11 UNI Signalling

The UNI signalling procedures as defined in [3] section 5 are not supported.

4 Approval Requirements

With the adoption of the Radio Equipment and Telecommunications Terminal Equipment (RTTE) Directive, 99/05/EC, transposed into UK law by The Radio Equipment and Telecommunications Terminal Equipment Regulations 2000 (SI 2000 No.730), the concept of particular types of equipment having to meet specific approval requirements no longer applies. Preceding approval requirements no longer have any regulatory force although they may be useful in assisting manufacturers to comply with the Directive's essential requirements.

Under the RTTE, apparatus may be placed on the market and put into service provided it complies with the applicable essential requirements of the Directive.

The following essential requirements are applicable to all apparatus:

- the protection of the health and safety of the user and any other person, including the objectives with respect to safety requirements contained in the Low Voltage Directive 73/23/EEC (but as if there were no voltage limit);

- protection requirements with respect to electromagnetic compatibility contained in the EMC Directive 89/336/EEC.

There is an additional essential requirement that applies to radio equipment:

- radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communication and orbital resources so as to avoid harmful interference.

The RTTE directive is available at;

http://www.tapc.org.uk/document/RTTE OJ version.pdf

Article 3 on page 6 dealing with essential requirements is of particular relevance.

For general information about the application of the RTTE Directive and an up-to-date listing of the very limited number of products to which additional essential requirements apply please go to the DTI website:

http://www.tapc.org.uk/RTTE/Index.html

END