OBSAI

OPEN BASE STATION ARCHITECTURE INITIATIVE

Reference Point 2 Specification

Version 2.1

Contents

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Comments on specifications and requests for interpretations should be addressed to:

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1 Summary of changes

Version	Date	Comment
1.0	06/26/2003	First version
1.1	07/25/2003	Editorial changes
2.0	04/27/2006	Support for WiMAX added
2.01	03/03/2008	LTE support
2.02	06/05/2008	Review updates
2.1	07/14/2008	OBSAI Management Board approval

2 Scope

This document specifies the BTS internal Reference Point 2 (RP2) as defined by the OBSAI Reference Architecture [OBSAI System].

Modules are physical embodiments (implementations) of Functional Blocks. In addition to specified modules (Transport, Control, Baseband and RF) the notion of Proprietary Modules has been introduced in [OBSAI System].

Conceptually, the characteristics of a Reference Point apply to associated Module Interfaces. For example, the characteristics of RP2 apply to an interface at one or more Transport Modules and to an interface at one or more Baseband Modules. Figure 1 below illustrates this idea.

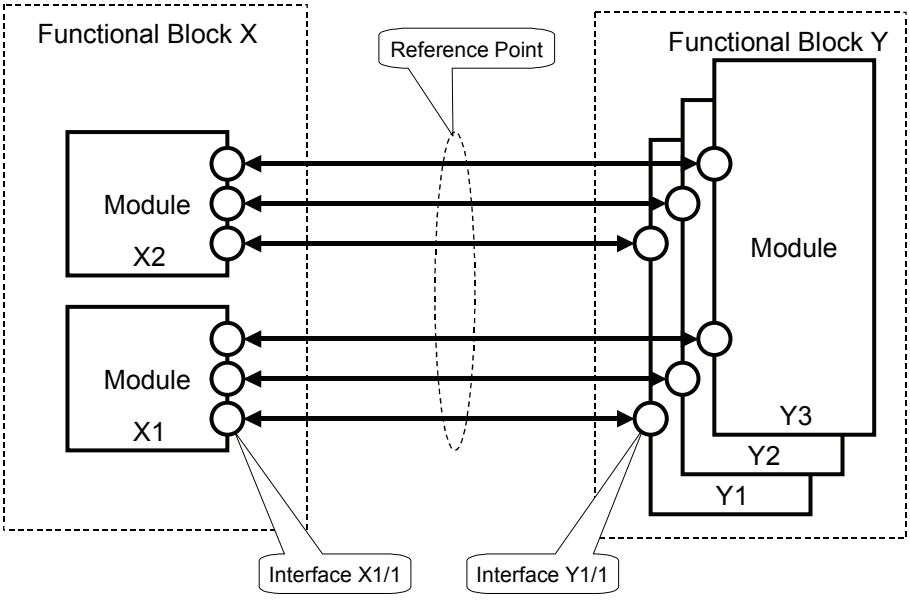

Figure 1 Reference Point vs. Module Interface

The physical interface implementation (e.g. backplane interface) of different modules associated to the same Reference Point may be very different. Due to that, the RP related interface specifications are provided in designated chapters of respective "Module Interface Specifications".

Reference Point 2 specifies the characteristics of the User Plane (U-Plane, a.k.a. "payload").

The Control Plane (C-Plane, a.k.a. "signaling") and Management Plane (M-Plane, a.k.a. "OAM&P") belong to RP1 (see [OBSAI RP1]).

The same protocol specifications related to the Physical, Data Link and Network Layer apply to both Reference Points. For that reason, respective subchapters concern both RP1 and RP2.

In chapter 3 the topology concept is introduced. Chapter 4 gives an overview of the protocol architecture. Layer 1 to 4 protocols are specified in subsequent chapters.

3 Topology

3.1 Basic Principles

The OBSAI BTS architecture has been designed based on well-known Local Area Networking (LAN) concepts. Data transport is performed by Ethernet switching and IP routing. From network topology point of view, RP1 and RP2 shall adhere to following principles:

- Communication between modules within one shelf shall be based on star topology.
- The Transport Module shall be the center of the star topology. It performs Ethernet switching functions to allow for communication between any two modules.
- If Transport Module redundancy is supported, the backup Transport Module shall be the center of a backup star network (double star topology).
- To support shelf extension, the Transport Module residing in the primary shelf shall have a point-to-point connection to the center of a secondary star network in the secondary shelf (cascaded star topology). This requires an Extension Module (EM) to be located in the second shelf. The Extension Module is considered as a Proprietary Module and will not be specified (see chapter 3.2).

Figure 2 below illustrates these principles in the basic configuration: single baseband shelf with dual star network for RP1+2.

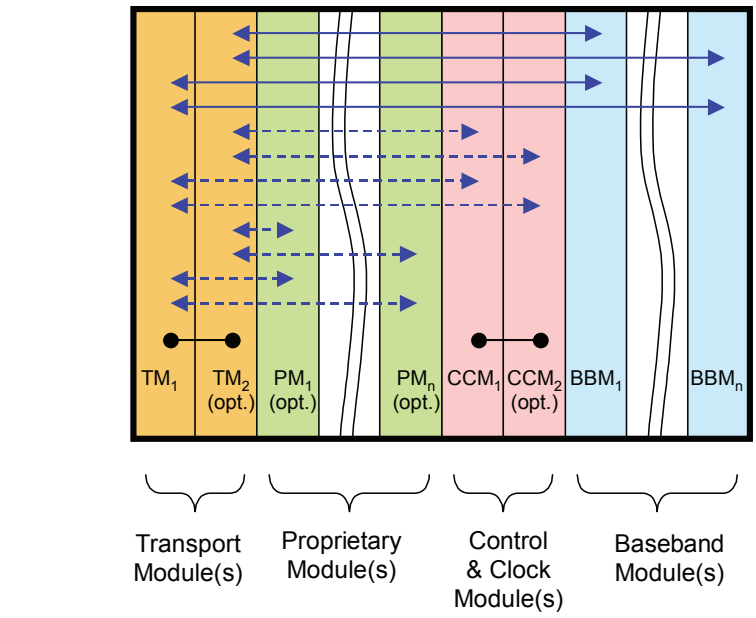

Figure 2 Dual Star Topology

With this version of the document, it is expected that all modules of the same function/mode (e.g. TM, CCM) will be manufactured by the same vendor. Therefore, redundancy control links between modules are not specified.

3.2 Shelf Extension (Optional)

Shelf extension is optional and not specified with this document version. As an example, shelf extension for U/C/M-Plane within a single BTS cabinet is illustrated in Figure 3 below. If Baseband modules are present in an extension shelf (2), both Control/Management Plane and User Plane have to be extended. If they are not present (3), only the Control/Management Plane has to be extended.

For extension of the Synchronization Plane refer to [OBSAI RP1].

Cabinet extension is not supported with this document version.

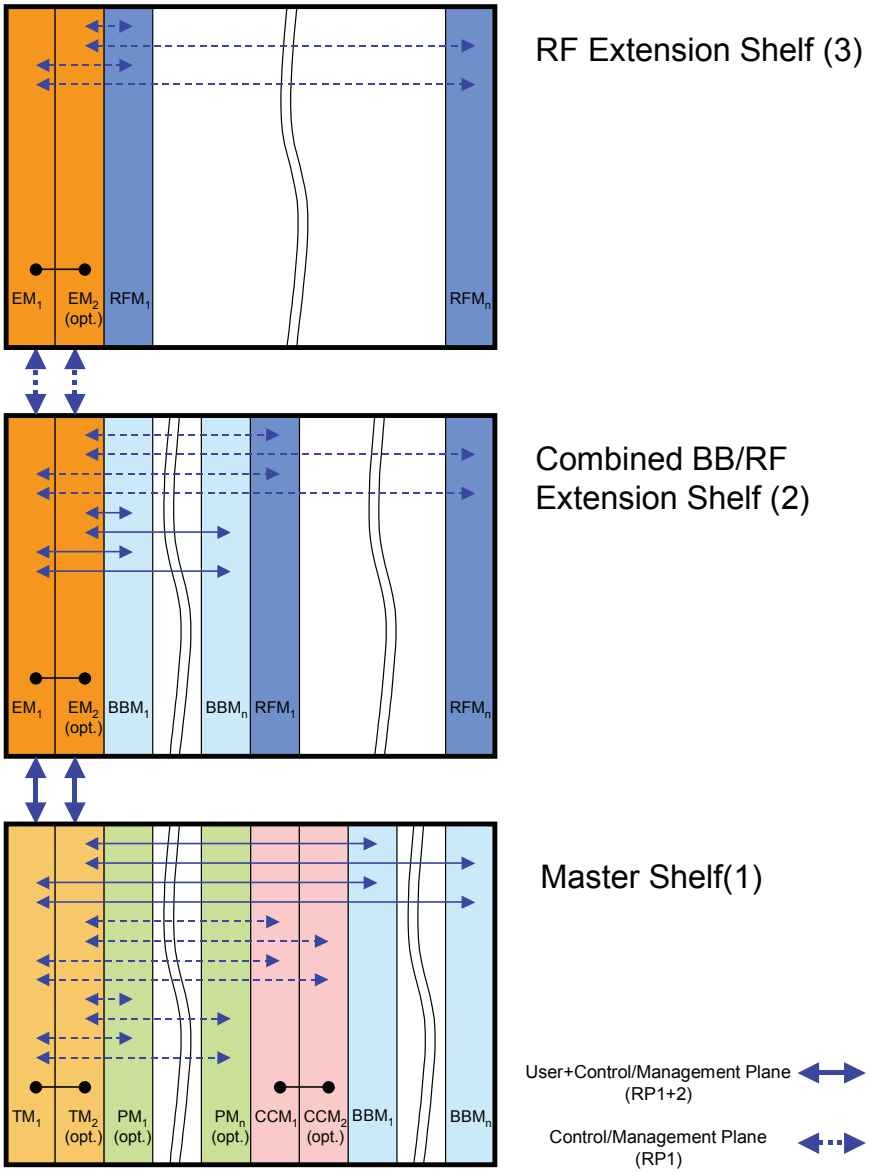

Figure 3 Shelf Extension for U/C/M-Plane

4 Protocol Architecture

4.1 Basic Principles

The transport infrastructure for RP1 and RP2 shall be built upon well-known LAN technologies, namely Ethernet and IP. This applies to User (U), Control (C) and Management (M) Planes. Other technologies are required for the Synchronization Plane, which is specified in [OBSAI RP1].

As stated in [OBSAI System], the Transport Module (TM) shall support only Transport Network Layer (TNL) functions. In particular the Transport Module shall NOT terminate any external Radio Network Layer (RNL) related protocols. All external RNL traffic (User Plane, Control Plane and Management Plane) is passing transparently through the Transport Module, but shall be handled according to associated QoS attributes.

External RNL protocols shall be terminated at the

- Control & Clock Module (CCM) - terminating upper layers of RNL Management Plane and Control Plane protocols
- Baseband Module (BBM) - terminating upper layers of the RNL User Plane and optionally Control Plane (e.g. DNBAP) protocols

An embodiment of RP1 consists of links between a Control & Clock Module (CCM) and any other module within the same shelf via the Transport Module. There is one link per any other module.

An embodiment of RP2 consists of links between a Transport Module (TM) and Baseband Module(s) (BBM). There is one link per Baseband Module.

Figure 4 gives an overview of the protocol architecture. This will be explained in details in the following chapters.

Note: For simplicity reasons, the following diagrams illustrate external C-Plane termination at the CCM. External C-Plane termination at the BBM (e.g. DNBAP) is not shown.

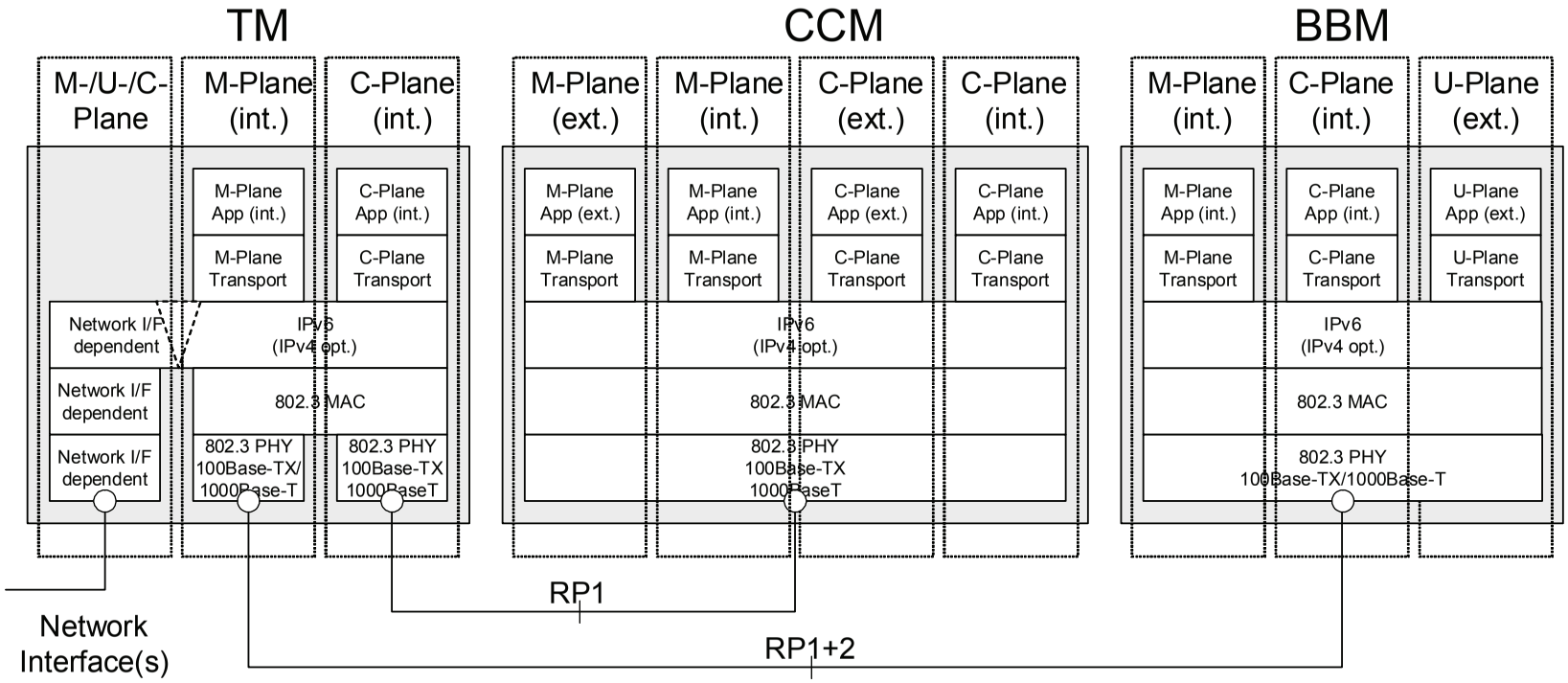

Figure 4: Protocol Overview

4.2 Physical Layer (Layer 1)

Module interfaces associated with RP1 and RP2, which are not used for shelf extension purposes and support of a “High-Capacity BBM”, shall support the Physical Layer (PHY) of Ethernet 100Base100B-TX according to [IEEE802.3], clause 25 (Fast Ethernet) or Gigabit Ethernet. For short distance 1000Base-TX [TIA/EIA-854] and for longer distance 1000Base-T according clause 40 of [IEEE802.3] should be used.

4.3 Data Link Layer (Layer 2)

Interfaces associated with RP1 and RP2 shall support the Data Link Layer of Ethernet (MAC) according to [IEEE802.3].

VLAN techniques (IEEE802.3p/q) are not used.

The Data Link Layer latency (Ethernet switching delay) between any two interfaces shall not exceed 100μs.

4.4 Network Layer (Layer 3)

Interfaces associated with RP1 and RP2 shall support IP Version 6 (IPv6) according to [RFC 2460] at the Network Layer.

The additional support of IP Version 4 (IPv4) according to [RFC 791] is optional.

The Network Layer latency shall not exceed 1ms.

If the Network Interface is IP based IP packet scheduling and prioritization shall be supported using the principles of Differentiated Services (DiffServ) according to [RFC 2474], [RFC 2475], [RFC 3086], [RFC 2597], [RFC 3140] and [RFC 3246].

IP DiffServ Code Point (DSCP) marking shall be supported at the protocol termination points. Following code points shall be used:

Plane	Service	PHB	Code Point
U-Plane	Voice	EF	101110
	QoS guaranteed data	AF4, medium drop precedence	100100
	QoS non-guaranteed data	AF3, high drop precedence	011100
C-Plane		AF3, low drop precedence	011010
M-Plane		AF2, high drop precedence	010110

Table 1 IP DiffServ Code Points

4.5 Transport Layer (Layer 4)

Interfaces associated with RP2 shall support UDP [RFC 768] or GRE [RFC 1701] at the Transport Layer. To adapt to any type of Network Interface (e.g. TDM, ATM, FR, IP based), the Transport Module shall perform an Interworking Function (IWF).

As an example, if the Network Interface is ATM based, the User Plane data may be carried over AAL2. In this case, the IWF (adaption and signalling) shall conform to [Q.AAL2IP.CS1] and [Q.IPC.CS1], as defined by ITU-T (Study Group 11). AAL2 connections at the Network Interface are controlled with the ALCAP signaling protocol according to [Q.2630.2] with a signaling protocol bearer according to [Q.2100] and [Q.2150.2]. The AAL2-IP Signalling Interworking Function, a.k.a. IP Connection Control (IPC) signalling, a.k.a. IP-ALCAP, is responsible for exchanging the underlying transport protocol according to given Transport Associations (TA). Transport Associations are set up dynamically between {physical interface + ATM VPI/VCI + AAL2 CID} and {IP address + UDP port number}.

As another example, if the Network Interface is using GRE for User Plane multiplexing (e.g. with WiMAX Forum R6), the BTS internal User Plane multiplexing at RP2 will also be based on GRE. An IWF located at the TM will do the adaptation.

In the special case that the Network Interface is UDP/IP based, the IWF may be reduced to a null function. That means, the Transport Module acts as an IP router. Transport Layer PDU's are passing through transparently.

In case of LTE IWF can terminate the GTP-U tunnel or the GTP-U tunnel may be terminated in the BB-processing block. The first solution will decrease the amount of IP addresses visible in a terrestrial network. The second option will make the ciphering implementation easier (since the only place which is required to undertake management of U-plane security is now in the BB processing block)

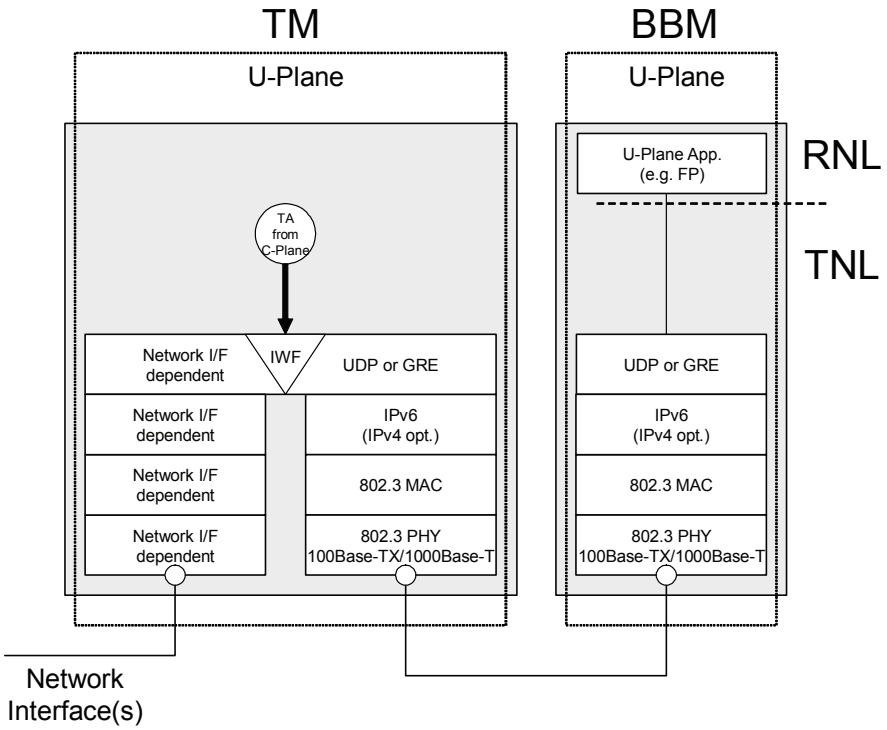

Figure 5 User Plane

4.6 Upper Layers

External Radio Network Layer (RNL) User Plane protocols have been defined by standardization bodies dedicated to the specification of RAN/BSS functions. They are beyond the scope of OBSAI. Examples are

- 3GPP Iub FP [3GPP TS 25.427]
- 3GPP2 Abis/A3
- WiMAX Forum R6
- 3GPP S1 and S2

External User Plane protocols are terminated at the BBM. The TM shall pass through respective PDU's transparently and shall not perform any protocol termination or conversion of RNL protocols.

5 Abbreviations

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

AF	Assured Forwarding
ALCAP	Access Link Control Application Part
BBM	Baseband Module
C-Plane	Control Plane
CCM	Control & Clock Module
DNBAP	Dedicated NBAP
EF	Expedited Forwarding
EM	Extension Module
FP	Frame Protocol (3GPP)
GTP-U	3GPP specified user plane tunnelling protocol over UDP/IP
GRE	Generic Routing Encapsulation
IPC	IP Connection Control
IWF	Interworking Function
M-Plane	Management Plane
NBAP	NodeB Application Protocol
PM	Proprietary Module
RNL	Radio Network Layer
RP	Reference Point
RFM	RF Module
SCTP	Stream Control Transmission Protocol
TA	Transport Association
TM	Transport Module
TNL	Transport Network Layer
U-Plane	User Plane
UDP	User Datagram Protocol
VLAN	Virtual LAN

6 References

[OBSAI System]	Title:	OBSAI System Reference Document
	Version:	
	Author:	OBSAI
[OBSAI RP1]	Title:	OBSAI Reference Point 1 Specification
	Version:	
	Author:	OBSAI
[Q.IPC.CS1]	Title:	Draft Recommendation Q.IPC.CS1: IP Connection Control Signalling Protocol (Capability Set 1)
	Version:	TD 25R1 (WP4/11); 22nd November 2002
	Author:	ITU-T
[Q.AAL2IPIW.CS1]	Title:	Draft Recommendation Q.AALIP.CS1: AAL type 2 to IP interworking capability set 1.
	Version:	TD TD18R1 (WP4/11), 22nd November 2002
	Author:	ITU-T
[RFC 768]	Title:	User Datagram Protocol
	Version:	August 1980
	Author:	IETF
[RFC 791]	Title:	Internet Protocol
	Version:	September 1981
	Author:	IETF
[RFC 1701]	Title:	Generic Routing Encapsulation (GRE)
	Version:	October 1994
	Author:	IETF
[RFC 2460]	Title:	Internet Protocol, Version 6
	Version:	December 1998
	Author:	IETF

References

[RFC 2474]	Title:	Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers
	Version:	December 1998
	Author:	IETF
[RFC 2475]	Title:	An Architecture for Differentiated Services
	Version:	December 1998
	Author:	IETF
[RFC 2597]	Title:	Assured Forwarding PHB Group
	Version:	June 1999
	Author:	IETF
[RFC 3068]	Title:	Definition of Differentiated Services Per Domain Behaviors and Rules for their Specification
	Version:	April 2001
	Author:	IETF
[RFC 3140]	Title:	Per Hop Behavior Identification Codes
	Version:	June 2001
	Author:	IETF
[RFC 3246]	Title:	An Expedited Forwarding PHB
	Version:	March 2002
	Author:	IETF
[IEEE 802.3]	Title:	IEEE Std 802.3, 2000 Edition Digital Interfaces
	Version:	2000
	Author:	IEEE
[TS 36.414]	Title:	S1/Data transport
	Version:	
	Author:	3GPP
[TS 36.424]	Title:	X2 Data transport
	Version:	
	Author:	3GPP
[TS 36.413]	Title:	S1 Control
	Version:	
	Author:	3GPP
[TS 36.424]	Title:	X2 Control
	Version:	
	Author:	3GPP

[TIA/EIA-854]	Title:	TIA/EIA-854 Full Duplex Ethernet Specification for 1000Mbis/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling.
	Version:	
	Author:	Telecommunications Industry Association, 2001

- Note : If no version number is given, reference is always made to the latest version of a document.