



TECHNICAL REPORT

**Information technology –
Part 372: Fibre channel methodologies for interconnects-2 (FC-MI-2)**



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INFORMATION TECHNOLOGY – FIBRE CHANNEL –

Part 372: Fibre channel methodologies for interconnects-2 (FC-MI-2)

FOREWORD

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ISO/IEC 14165-372, which is a technical report, has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The list of all currently available parts of the ISO/IEC 14165 series, under the general title *Information technology – Fibre Channel*, can be found on the IEC web site.

This Technical Report has been approved by vote of the member bodies and the voting results may be obtained from the address given on the second title page.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

INTRODUCTION

This technical report specifies common methodologies for both Arbitrated Loop and Switched environments. The goal of this technical report is to facilitate interoperability between devices whether they are connected in a loop or Fabric topology.

INFORMATION TECHNOLOGY – FIBRE CHANNEL –

Part 372: Fibre channel methodologies for interconnects-2 (FC-MI-2)

1 Scope

This part of ISO/IEC 14165 is intended to document interoperability behavior for Fabric elements (i.e., E_Port, F_Port, FL_Port). This Technical Report includes a wide range of issues such as link initialization, error detection, error recovery, Fabric operation, management capabilities, and zoning.

This Technical Report serves as an implementation guide, whose primary objective is to maximize the likelihood of interoperability between conforming implementations. This Technical Report prohibits or requires some features that are in the referenced documents.

A second objective of this Technical Report is to simplify implementations and their associated documentation, testing, and support requirements. As a result there may be some optional features of the referenced documents that are not mutually exclusive, but are prohibited or required for the purpose of this simplification. Features that some but not all of the referenced documents require for compliance may be optional in this report. Each specification of such an optional feature in this report identifies the referenced document for which the feature is required.

Internal characteristics of conformant implementations are not defined by this Technical Report, but it incorporates features from the documents cited in clause 2.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the of the referenced document (including any amendments) applies.

The provision of the referenced specification other than ISO/IEC, IEC, ISO and ITU documents, as identified in this clause, are valid within the context of this Technical Report. The reference of such a specification within this Technical Report does not give it any further status within ISO/IEC. In particular, it does not give the referenced specification the status of an International Standard.

ISO/IEC 14165-115, *Information technology – Fibre channel – Part 115: Physical Interfaces (FC-PI)* ²

ISO/IEC 14165-122, *Information technology – Fibre Channel – Part 122: Arbitrated loop-2 (FC-AL-2)* ³

ISO/IEC 14165-133, *Information technology – Fibre channel – Part 133: Fibre Channel Switch Fabric-3 (FC-SW-3)* ⁴

T11/Project 1620D, *Fibre Channel - Link Services (FC-LS)* ⁵

INCITS TR-36-2003, *Fibre Channel - Device Attach (FC-DA)* ⁶

2. ANSI INCITS 352-2002, *Fibre Channel - Physical Interfaces (FC-PI)*

3. ANSI INCITS 332-1999, *Fibre Channel - Arbitrated Loop (FC-AL-2)*

4. ANSI INCITS 384-2004, *Fibre Channel - Switch Fabric - 3 (FC-SW-3)*

5. ISO/IEC 14165-261, *Information technology – Fibre Channel – Part 261: Link services (FC-LS)*
(under consideration)

6. ISO/IEC 14165-341, *Information technology – Fibre Channel – Part 341: Device attach (FC-DA)*
(under consideration)

ISO/IEC 14165-414, Information technology – Fibre Channel – Part 414: Generic services-4 (FC-GS-4) ⁷
ISO/IEC 14165-431, *Information technology – Fibre Channel – Part 431: Security Protocols (FC-SP)*
(to be published) ⁸
Internet Engineering Task Force RFC 791, Internet Protocol, September 1981
Internet Engineering Task Force RFC 2373, IP Version 6 Addressing Architecture, July 1998
Internet Engineering Task Force RFC 2460, Internet Protocol, Version 6 (IPv6) Specification, December 1998
Internet Engineering Task Force RFC 3410, Introduction and Applicability Statements for Internet Standard Management Framework, December 2002
Internet Engineering Task Force RFC 4044, Fibre Channel Management MIB, May 2005

3 Terms, definitions, abbreviations and other conventions

3.1 Overview

For the purpose of this document the following definitions, conventions, abbreviations, acronyms, and symbols apply.

3.2 Terms and definitions

3.2.1

address identifier

address value used to identify source (S_ID) or destination (D_ID) of a frame

3.2.2

AL_PA bit map

bit map that shows which ports are present on an Arbitrated Loop

NOTE See FC-AL-2.

3.2.3

AL_PA position map

map that shows port ordering on an Arbitrated Loop

NOTE See FC-AL-2.

3.2.4

Arbitrated Loop time out value

AL_Time

time interval defined by FC-AL-2

3.2.5

Application

entity that makes requests of a Service

3.2.6

Arbitrated Loop Physical Address

AL_PA

one-byte address value

NOTE See FC-AL-2.

7. ANSI INCITS 387-2004, *Fibre Channel - Generic Services - 4 (FC-GS-4)*

8. T11/Project 1570D, *Fibre Channel - Security Protocols (FC-SP)*

3.2.7

AR0

special AR (see 3.2.9) containing only the switch backbone network, that in general may consist of point-to-point links, broadcast links, and switching devices

NOTE See FC-AL-2.

3.2.8

Area Identifier

second or middle level of the three-level addressing hierarchy, found in bits 15 through 8 of an address identifier

NOTE (see 3.2.1) and FC-SW-3.

3.2.9

Autonomous Region

AR

one or more Fibre Channel address domains consisting of switches that all run a common routing protocol

NOTE See FC-SW-3.

3.2.10

B_Port

Interconnect_Port used to connect bridge devices with E_Ports on a switch

NOTE See FC-SW-3.

3.2.11

Domain Identifier

highest level of the three-level addressing hierarchy, found in bits 23 through 16 of an address identifier (see 3.2.1)

NOTE See FC-SW-3.

3.2.12

E_Port

Fabric Expansion port that attaches to another Interconnect_Port to create an Inter-Switch Link

NOTE See FC-SW-3.

3.2.13

Entry Switch

role that a switch assumes with respect to a distributed service request

NOTE The switch that is attached to an Nx_Port making a service request assumes the role of an entry switch with respect to that request. See FC-SW-3.

3.2.14

Error_Detect_Timeout value

E_D_TOV

time interval defined in FC-FS-2

3.2.15

F_Port

port through which non-loop N_Ports are attached to a Fabric, and it does not include FL_Ports

3.2.16

Fabric

Fibre Channel frame transport infrastructure that includes switches and interconnects various Nx_Ports attached to it

3.2.17**Fabric F_Port**

entity at the well-known address FFFFFFFEh

NOTE See FC-SW-3.

3.2.18**Fabric_Name**

identifier associated with a Fibre Channel Fabric

NOTE See FC-FS-2.

3.2.19**Fabric Shortest Path First****FSPF**

link state protocol used for Path Selection

NOTE See FC-SW-3.

3.2.20**FC_Port**

port transmitting or receiving Fibre Channel frames

NOTE FC_Port includes any port type defined in the Fibre Channel family of standards (e.g., N_Port, F_Port, FL_Port, E_Port).

3.2.21**FL_Port**

L_Port that is able to perform the function of an F_Port, attached via a link to one or more NL_Ports in an Arbitrated Loop topology (see FC-AL -2)

NOTE The AL_PA of an FL_Port is 00h. In this Technical Report, an FL_Port is assumed to always refer to a port to which NL_Ports are attached to a Fabric; it does not include F_Ports.

3.2.22**Fx_Port**

Switch Port (see 3.2.52) capable of operating as an F_Port or FL_Port

3.2.23**Gateway/Bridge**

any device that interfaces FC to some other interface (see FC-FS-2)

NOTE The definition of such a device is outside the scope of this report.

3.2.24**Hub**

interconnect element used with Arbitrated Loops

NOTE A Hub may be a stand-alone enclosure, or part of an integrated system (e.g., such as the connection point within a JBOD). Typically a Hub is transparent to any connected Fibre Channel devices.

3.2.25**Interconnect_Port**

E_Port or a B_Port

3.2.26**Loop Fabric Address****LFA**

address identifier used to address an FL_Port (see FC-SW-3) for the purpose of loop management

NOTE See 6.4 and FC-LS.

3.2.27**L_Port**

port that contains Arbitrated Loop functions associated with the Arbitrated Loop topology

NOTE See FC-AL-2.

3.2.28

Managed Hub

Hub (see 3.2.24) that provides either in-band or out-of-band management functions

3.2.29

Name Server

Server (see 3.2.48) that allows registration and reporting of various objects

NOTE See FC-GS-4.

3.2.30

N_Port

direct Fabric-attached port that does not include NL_Ports

NOTE See FC-FS-2.

3.2.31

N_Port Identifier

1 Fabric unique address identifier by which an N_Port is known

NOTE The identifier is used in the S_ID and D_ID fields of a frame (see FC-FS-2).

2 Name Server object (see FC-GS-4) containing the Fibre Channel address identifier assigned to an N_Port or NL_Port

3.2.32

NL_Port

L_Port that is able to perform the function of an N_Port, attached to one or more NL_Ports and zero or more FL_Ports in an Arbitrated Loop topology

NOTE In this technical report, an NL_Port is assumed to always refer to a loop-attached port including both Private NL_Ports and Public NL_Ports, and does not include N_Ports.

3.2.33

Node_Name

identifier associated with a Fibre Channel node

NOTE See FC-FS-2.

3.2.34

Non-Participating mode

operational mode of an L_Port that does not have an AL_PA, but is enabled into the Loop

NOTE See FC-AL-2.

3.2.35

Nx_Port

port operating as an N_Port or NL_Port

3.2.36

OLD-PORT

state on a set of ports where two devices operate in a point-to-point mode utilizing FC-FS-2 protocols instead of FC-AL-2 protocols

NOTE See FC-AL-2 and FC-FS-2.

3.2.37

OPEN_INIT

state in the LPSM as defined in FC-AL-2

3.2.38**N_Port_Name**

identifier associated with an FC_Port

NOTE See FC-FS-2.

3.2.39**Partial Response**

response from a Distributed Service that may not have a complete set of data

NOTE See FC-SW-3.

3.2.40**Participating mode**

operational mode of an L_Port that has an AL_PA and is enabled into the Loop

NOTE See FC-AL-2.

3.2.41**Platform**

association of one or more nodes for the purpose of discovery and management

3.2.42**Port**

N_Port, NL_Port, F_Port, FL_Port, B_Port, or E_Port, used in a context where the distinction between specific port types is clarified by other text or not significant

3.2.43**Port Identifier**

lowest level of the three-level addressing hierarchy, found in bits 7 through 0 of an address identifier (see 3.2.1)

NOTE See FC-SW-3.

3.2.44**Private NL_Port**

NL_Port that is observing the rules of private loop behavior

NOTE See FC-AL-2 and FC-DA.

3.2.45**Public NL_Port**

NL_Port that attempts a fabric login and may transfer frames through the FL_Port

NOTE A Public NL_Port observes the rules of public loop behavior and/or private loop behavior. See FC-AL-2 and FC-DA.

3.2.46**Receiver_Transmitter_Timeout value****R_T_TOV**

time interval defined in FC-FS-2

3.2.47**Resource_Allocation_Timeout value****R_A_TOV**

time interval defined in FC-FS-2

3.2.48**Server**

entity that accepts CT requests and provides CT responses

NOTE 1 A Server is accessed via a Service (e.g., the Name Server is accessed using the Directory Service).

NOTE 2 See FC-GS-4.

3.2.49

Service

service provided by a node, accessible via an N_Port that is addressed by a Well-Known Address (e.g., the Directory Service and the Alias Service)

NOTE A Service provides access to one or more Servers, see FC-GS-4.

3.2.50

Speed Negotiation

process that allows an FC_Port capable of multiple operating speeds and connected to another FC_Port that may or may not have the same capability to arrive at the optimum speed of operation

NOTE See FC-FS-2.

3.2.51

Switch

element that makes up the switching portion of the Fabric

NOTE See FC-SW-3.

3.2.52

Switch Port

E_Port, B_Port, F_Port, or FL_Port

3.2.53

Symbolic Name

user-defined name for an object, up to 255 characters in length

NOTE The Directory Service (see FC-GS-4) does not guarantee uniqueness of its value.

3.2.54

Well-Known Address

WKA

address identifier defined to access a Service

NOTE See FC-FS-2.

3.2.55

Zone

group of Zone Members

NOTE Members of a Zone are made aware of each other, but not made aware of Zone Members outside the Zone. See FC-GS-4 and FC-SW-3.

3.2.56

Zone Member

specification of a device to be included in a Zone

NOTE See FC-GS-4 and FC-SW-3.

3.2.57

Zone Set

set of Zones that are used in combination

NOTE See FC-GS-4 and FC-SW-3.

3.3 Editorial conventions

In FC-MI-2, a number of conditions, mechanisms, sequences, parameters, events, states, or similar terms are printed with the first letter of each word in uppercase and the rest lowercase (e.g., Exchange, Class). Any lowercase uses of these words have the normal technical English meanings.

Lists sequenced by letters (e.g., a-red, b-blue, c-green) show no ordering relationship between the listed items. Numbered lists (e.g., 1-red, 2-blue, 3-green) show a ordering between the listed items.

The ISO/IEC convention of numbering is used (i.e., the thousands and higher multiples are separated by a space and a comma is used as the decimal point.) A comparison of the American and ISO conventions are shown in table 1.

Table 1 – ISO/IEC and American Conventions

ISO/IEC	American
0,6	0.6
1 000	1,000
1 323 462,9	1,323,462.9

In case of any conflict between figure, table, and text, the text, then tables, and finally figures take precedence. Exceptions to this convention are indicated in the appropriate clauses.

In all of the figures, tables, and text of this document, the most significant bit of a binary quantity is shown on the left side. Exceptions to this convention are indicated in the appropriate clauses.

When the value of the bit or field is not relevant, x or xx appears in place of a specific value.

Numbers that are not immediately followed by lower-case b or h are decimal values.

Numbers immediately followed by lower-case b (xxb) are binary values.

Numbers or upper case letters immediately followed by lower-case h (xxh) are hexadecimal values.

3.4 Abbreviations and acronyms

Abbreviations and acronyms applicable to this Technical Report are listed. Definitions of several of these items are included in 3.2.

ABTS	Abort Sequence
ACC	Accept
ADISC	Discover Address
AL_PA	Arbitrated Loop Physical Address, see FC-AL-2
AL_PD	Arbitrated Loop Destination Address, see FC-AL-2
AL_Time	Arbitrated Loop Time out value, see FC-AL-2
AR	Autonomous Region, see FC-SW-3
CLS	Close Primitive Signal, see FC-AL-2
CT	Common Transport, see FC-GS-4
CT_IU	Common Transport Information Unit, see FC-GS-4
D_ID	Destination address identifier
E_D_TOV	Error_Detect_Timeout value
EFP	Exchange Fabric Parameters, see FC-SW-3
ELP	Exchange Link Parameters, see FC-SW-3
ELS	Extended Link Service, see FC-SW-3
FAN	Fabric Address Notification Extended Link Service
FLOGI	F_Port Login
FSPF	Fabric Shortest Path First, see FC-SW-3
GS	Fibre Channel Generic Service

HBA	Host Bus Adapter
IDLE	Idle Word
IP	Internet Protocol, see RFC 791, RFC 2373, and RFC 2460
ISL	Inter-Switch Link, see FC-SW-3
IU	Information Unit
LFA	Loop Fabric Address
LIFA	Loop Initialization Fabric Assigned, see FC-AL-2
LINIT	Loop Initialization Request, see FC-LS
LIP	Loop Initialization Primitive Sequence, see FC-AL-2
LIRR	Link Incident Report Registration, see FC-LS
LISM	Loop Initialization Select Master, see FC-AL-2
LS_ACC	Link Service Accept
LSTS	Loop Status, see FC-LS
LOGO	Logout
LPSM	Loop Port State Machine, see FC-AL-2
LP_TOV	Loop Time out Value, see FC-AL-2
LS_RJT	Link Service Reject
NPIV	N_Port_ID Virtualization, see FC-LS
OPN	Open Primitive Signal, see FC-AL-2
PLOGI	N_Port Login
RLIR	Registered Link-Incident Record
RLS	Read Link Error Status Block
RNID	Request Node Identification Data Extended Link Service
RPS	Read Port Status block
RSCN	Registered State Change Notification
R_T_TOV	Receiver_Transmitter_Timeout value
S_ID	Source address identifier
SAN	Storage Area Network
SNMP	Simple Network Management Protocol, see RFC 3410
SW_ILS	Switch Internal Link Service, see FC-SW-3
UDP	User Datagram Protocol, see RFC 768
ULP	Upper Level Protocol
WAN	Wide Area Network
WKA	Well-Known Address

3.5 Symbols

Unless indicated otherwise, the following symbol has the listed meaning.

|| concatenation

3.6 Keywords

expected

A keyword used to describe the behavior of the hardware or software in the design models assumed by this technical report. Other hardware and software design models may also be implemented.

ignored

A keyword used to describe an unused bit, byte, word, field or code value. The content- or value of an ignored bit, byte, word, field or code value shall not be examined by the receiving device and may be set to any value by the transmitting device.

invalid

A keyword used to describe an illegal or unsupported bit, byte, word, field or code value. Receipt of an invalid bit, byte, word, field or code value shall be reported as an error.

mandatory

A keyword indicating an item that is required to be implemented as defined in this report.

may

A keyword that indicates flexibility of choice with no implied preference (equivalent to “may or may not”).

may not

A keyword that indicates flexibility of choice with no implied preference (equivalent to “may or may not”).

obsolete

A keyword indicating that an item was defined in prior Fibre Channel standards but has been removed from a subsequent Fibre Channel standard.

optional

A keyword that describes features that are not required to be implemented by the referenced standard. However, if any optional feature is implemented, then it shall be implemented as defined in the referenced standard.

reserved

A keyword referring to bits, bytes, words, fields and code values that are set aside for future standardization. A reserved bit, byte, word or field shall be set to zero, or in accordance with a future extension. Recipients are not required to check reserved bits, bytes, words or fields for zero values. In defined fields, receipt of reserved code values shall be reported as an error.

restricted

A keyword referring to bits, bytes, words, and fields that are set aside for use in other standards. A restricted bit, byte, word, or field shall be treated as a reserved bit, byte, word or field for the purposes of the requirements defined in this Technical Report.

shall

A keyword indicating a mandatory requirement. Designers are required to implement all such mandatory requirements to ensure interoperability with other products that conform to this report.

should

A keyword indicating flexibility of choice with a strongly preferred alternative; equivalent to the phrase “it is strongly recommended”.

3.7 Applicability and use of this Technical Report

This Technical Report specifies which features shall be used (i.e., required) and which features shall not be used (i.e., prohibited) by interoperating compliant Fibre Channel implementations. Use of some features is optional (i.e., allowed). The use of such functions is either negotiated in a fixed and standard manner or the availability of the functions for use shall be determined in a standard manner.

The relationship between use as specified in this Technical Report and support as implemented by a product is subtle. If this Technical Report specifies that a feature shall be used, then a compliant implementation shall support it. In some cases, this Technical Report is asymmetric: to ensure interoperability when an optional feature is used, this Technical Report requires support for the infrastructure required to use the feature without specifying that the feature be used to conform to this Technical Report.

The requirements of this Technical Report are a proper subset of the various relevant standards. This Technical Report prohibits use of many features and options in these standards. Use of prohibited features may prevent interoperability with Fibre Channel devices complying to this Technical Report. This Technical Report does not prohibit implementation of features, only their use. Functions that are mandatory in the appropriate base standard are assumed to be implemented. Implementations may support features whose use is prohibited by this Technical Report and such prohibited features may be required for compliance with the relevant standards or other Technical Reports.

3.8 Feature Set table terms, definitions, and abbreviations

3.8.1 Overview

Features in this Technical Report are summarized in the form of Feature Set tables. These tables indicate whether the feature is Required, Prohibited, Invocable, or Allowed for compliance with this Technical Report; or whether a parameter is Required to be a particular value for compliance with this Technical Report. Features or parameters that are not listed do not affect interoperability.

In several tables within this Technical Report, there are references to notes associated with the table. These notes are normative and are mandatory requirements of this Technical Report.

3.8.2 Feature Set table terms and definitions

Terms and definitions are used to define usage of reference features or options provided by the applicable standards are described in table 2.

Table 2 – Feature Set table terms and definitions

Term	Definition
Prohibited	A feature that shall not be used between Fibre Channel devices compliant with this Technical Report. An implementation may use the feature to communicate with non-compliant implementations. This Technical Report does not prohibit the implementation of features, only their use between Fibre Channel devices compliant with this Technical Report. Use of a prohibited feature may prevent interoperability with Fibre Channel devices complying to this Technical Report.
Required	A feature or parameter value that shall be used between all Fibre Channel devices compliant with this Technical Report. Fibre Channel devices compliant with this Technical Report are required to implement the feature. An implementation may use the feature to communicate with non-compliant implementations. If a Fibre Channel device does not implement a required feature that device may not be interoperable with Fibre Channel devices complying to this Technical Report.
Allowed	A feature or parameter value that may be used between Fibre Channel devices compliant with this Technical Report. Fibre Channel devices compliant with this Technical Report are not required to implement the feature, but if they do, the feature shall be implemented as described in the applicable standard. The potential user of a feature may determine if the recipient supports that feature via a Required discovery process or a minimal response by the recipient.
Invocable	A feature or parameter that is required to be implemented by a device to which a request may be sent, but it is not required to be used by a requesting device.

3.8.3 Feature Set table abbreviations

Table 3 contains the key of table abbreviations used within this Technical Report.

Table 3 – Feature Set table key abbreviations

Key	Definition
P	Prohibited
R	Required
A	Allowed
I	Invocable
X	This parameter has no required value; any value is allowed.
-	This parameter is ignored or this feature is not applicable.

3.9 Feature testing compliance

While not a compliance vehicle in itself, this Technical Report should be used as the basis for compliance testing. As such, the relationship for the definitions of prohibited, required, allowed, and invocable (see 3.8) to compliance testing is described in table 4.

Table 4 – Feature testing compliance relationship to definitions

Term	Definition
Prohibited	A feature that is not allowed to be used in a compliant implementation. A compliance test shall only verify that the prohibited feature is not requested by a device. A compliance test shall not generate a request for the prohibited feature, since if it does so, the response is outside the scope of this Technical Report.
Required	A feature that is required to be implemented by a compliant device. A compliance test is allowed to verify that the feature is correctly requested, and responded to as specified in this Technical Report or other referenced standards and technical reports.
Allowed	If a device claims to implement the feature, the feature may be tested. If tested, the feature shall conform to the discovery mechanism and function as specified in this Technical Report and other referenced standards and technical reports. If a device claims to not implement a feature, the feature shall not be tested.
Invocable	A feature that is required to be implemented by a device to which a request may be directed, but it is not required to be used by a requesting device. A compliance test is allowed to verify that the request is correctly responded to as specified in this Technical Report or other referenced standards and technical reports.

3.10 Timing constraints

All timings defined in this Technical Report are meant to limit the amount of time a device takes to accomplish a task. These timings shall be measured on an unloaded system. A heavily loaded system may exhibit timings in excess of those specified. The term unloaded means that system activity is induced only in direct invocation of the feature under test.

4 Structure and concepts

This Technical Report defines an interoperability environment in which a compliant device adheres to certain sets of behavior (FC_Port Behavior) that allow for interoperability across a wide variety of topologies and management methods. This environment encompasses three areas.

- a) Management Behavior: The set of behaviors required to create an interoperable management environment.
- b) Loop Behavior: The set of behaviors required to create an interoperable Arbitrated Loop environment.
- c) Fabric Behavior: The set of behaviors required to create an interoperable Fabric environment.

FC_Port Behavior is defined as Loop Behavior, Fabric Behavior, and Management Behavior taken together.

All behaviors are interrelated (e.g., a Fabric may be required not only to meet Fabric Behavior but Loop and Management Behavior as well, or an adapter may be required to meet both Loop and Management Behavior). The level of behavior support in any particular device depends on the supported Management, Loop, FC_Port and Fabric functions.

A device may be non-compliant with this Technical Report, and still be compliant with the various referenced Fibre Channel Standards. However, devices not compliant with this Technical Report may not be interoperable.

5 Loop behaviors

5.1 Loop Initialization

5.1.1 Power On Behavior

During power on, after the transmitter has been enabled and 200 μ s of valid Fibre Channel signal at or above FC-PI minimum amplitude levels has been driven by the transmitter, an FL_Port that is not executing Speed Negotiation shall not disrupt the operation of the loop for more than 95 ms and shall begin forwarding transmission words or begin initialization within 95 ms.

NOTE 1 - The delay of 200 μ s of enforcement of limits on disruption recognizes that many HBAs and devices by design disrupt during power-on, and that most hubs isolate an attached device or HBA until it has presented at least 200 μ s of an FC-PI-compliant signal. The expectation is that any disruption caused by a device or HBA at power-on is harmless until after it has presented 200 μ s of valid signal, because until then it is isolated from the loop by its hub.

FC-FS-2 specifies the disruption of a loop that may result from attaching to it an FL_Port configured to execute Speed Negotiation. An FL_Port that is executing Speed Negotiation disrupts up to three times over a period not exceeding t_{disrupt2} . No period of disruption exceeds t_{disrupt1} . See FC-FS-2 for definitions and derivations of t_{disrupt1} and t_{disrupt2} .

5.1.2 Loop failure

An FL_Port shall not issue a LIP for loop failure based on loss of synchronization before the loss of synchronization exceeds R_T_TOV .