

Annex A

(normative)

Protocol Implementation Conformance Statement (PICS) proforma

A.1 Introduction

The supplier of a protocol implementation that is claimed to conform to ISO/IEC 8802.11: 1999 shall complete the following PICS proforma.

A completed PICS proforma is the PICS for the implementation in question. The PICS is a statement of which capabilities and options of the protocol have been implemented. The PICS can have a number of uses, including use

- a) By the protocol implementor, as a checklist to reduce the risk of failure to conform to the standard through oversight;
- b) By the supplier and acquirer, or potential acquirer, of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the standard PICS proforma;
- c) By the user, or potential user, of the implementation, as a basis for initially checking the possibility of interworking with another implementation (note that, while interworking can never be guaranteed, failure to interwork can often be predicted from incompatible PICS proformas);
- d) By a protocol tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A.2 Abbreviations and special symbols

A.2.1 Status symbols

M	mandatory
O	optional
O.<n>	optional, but support of at least one of the group of options labeled by the same numeral <n> is required
pred:	conditional symbol, including predicate identification

A.2.2 General abbreviations

N/A	not applicable
AD	address function capability
CF	implementation under test (IUT) configuration
FR	MAC frame capability
FS	frame sequence capability
PC	protocol capability
PICS	protocol implementation conformance statement

A.3 Instructions for completing the PICS proforma

A.3.1 General structure of the PICS proforma

The first part of the PICS proforma, Implementation identification and Protocol summary, is to be completed as indicated with the information necessary to identify fully both the supplier and the implementation.

The main part of the PICS proforma is a fixed questionnaire, divided into subclauses, each containing a number of individual items. Answers to the questionnaire items are to be provided in the rightmost column, either by simply marking an answer to indicate a restricted choice (usually Yes or No) or by entering a value or a set or a range of values. (Note that there are some items where two or more choices from a set of possible answers may apply. All relevant choices are to be marked in these cases.)

Each item is identified by an item reference in the first column. The second column contains the question to be answered. The third column contains the reference or references to the material that specifies the item in the main body of ISO/IEC 8802-11: 1999. The remaining columns record the status of each item, i.e., whether support is mandatory, optional, or conditional, and provide the space for the answers (see also A.3.4). Marking an item as supported is to be interpreted as a statement that all relevant requirements of the subclauses and normative annexes, cited in the References column for the item, are met by the implementation.

A supplier may also provide, or be required to provide, further information, categorized as either Additional Information or Exception Information. When present, each kind of further information is to be provided in a further subclause of items labeled A</> or X</>, respectively, for cross-referencing purposes, where </> is any unambiguous identification for the item (e.g., simply a numeral). There are no other restrictions on its format or presentation.

The PICS proforma for a station consists of A.4.1 through A.4.4 inclusive, and at least one of A.4.5, A.4.6, or A.4.7 corresponding to the PHY implemented.

A completed PICS proforma, including any Additional Information and Exception Information, is the PICS for the implementation in question.

NOTE—Where an implementation is capable of being configured in more than one way, a single PICS may be able to describe all such configurations. However, the supplier has the choice of providing more than one PICS, each covering some subset of the implementation's capabilities, if this makes for easier and clearer presentation of the information.

A.3.2 Additional information

Items of Additional Information allow a supplier to provide further information intended to assist in the interpretation of the PICS. It is not intended or expected that a large quantity of information will be supplied, and a PICS can be considered complete without any such information. Examples of such Additional Information might be an outline of the ways in which an (single) implementation can be set up to operate in a variety of environments and configurations, or information about aspects of the implementation that are outside the scope of this standard but have a bearing upon the answers to some items.

References to items of Additional Information may be entered next to any answer in the questionnaire, and may be included in items of Exception Information.

A.3.3 Exception information

It may happen occasionally that a supplier will wish to answer an item with mandatory status (after any conditions have been applied) in a way that conflicts with the indicated requirement. No preprinted answer will be found in the Support column for this. Instead, the supplier shall write the missing answer into the Support column, together with an X</> reference to an item of Exception Information, and shall provide the appropriate rationale in the Exception Information item itself.

An implementation for which an Exception Information item is required in this way does not conform to ISO/IEC 8802-11: 1999.

NOTE—A possible reason for the situation described above is that a defect in ISO/IEC 8802-11: 1999 has been reported, a correction for which is expected to change the requirement not met by the implementation.

A.3.4 Conditional status

The PICS proforma contains a number of conditional items. These are items for which both the applicability of the item itself, and its status if it does apply, mandatory or optional, are dependent upon whether or not certain other items are supported.

Where a group of items is subject to the same condition for applicability, a separate preliminary question about the condition appears at the head of the group, with an instruction to skip to a later point in the questionnaire if the Not Applicable (N/A) answer is selected. Otherwise, individual conditional items are indicated by a conditional symbol in the Status column.

A conditional symbol is of the form “<pred>:<S>”, where “<pred>” is a predicate as described below, and “<S>” is one of the status symbols M or O.

If the value of the predicate is true, the conditional item is applicable, and its status is given by S: the support column is to be completed in the usual way. Otherwise, the conditional item is not relevant and the N/A answer is to be marked.

A predicate is one of the following:

- a) An item-reference for an item in the PICS proforma: the value of the predicate is true if the item is marked as supported, and is false otherwise.
- b) A boolean expression constructed by combining item-references using the boolean operator OR: the value of the predicate is true if one or more of the items is marked as supported, and is false otherwise.

Each item referenced in a predicate, or in a preliminary question for grouped conditional items, is indicated by an asterisk in the Item column.

A.4 PICS proforma—ISO/IEC 8802-11: 1999⁷

A.4.1 Implementation identification

Supplier	
Contact point for queries about the PICS	
Implementation Name(s) and Version(s)	
Other information necessary for full identification, e.g., name(s) and version(s) of the machines and/or operating systems(s), system names	

NOTES

1—Only the first three items are required for all implementations. Other information may be completed as appropriate in meeting the requirement for full identification.

2—The terms Name and Version should be interpreted appropriately to correspond with a supplier's terminology (e.g., Type, Series, Model).

A.4.2 Protocol summary, ISO/IEC 8802-11: 1999

Identification of protocol standard	ISO/IEC 8802-11: 1999
Identification of amendments and corrigenda to this PICS proforma that have been completed as part of this PICS	Amd. : Corr. : Amd. : Corr. :
Have any exception items been required? (See A.3.3; the answer Yes means that the implementation does not conform to ISO/IEC 8802-11: 1999.)	Yes <input type="checkbox"/> No <input type="checkbox"/>
Date of statement (dd/mm/yy)	

⁷Copyright release for PICS proforma: Users of this standard may freely reproduce the PICS proforma in this annex so that it can be used for its intended purpose and may further publish the completed PICS.

A.4.3 IUT configuration

Item	IUT configuration	References	Status	Support
* CF1	What is the configuration of the IUT? Access Point (AP)	5.2	O.1	Yes <input type="checkbox"/> No <input type="checkbox"/>
* CF2	Independent station (<i>not</i> an AP)	5.2	O.1	Yes <input type="checkbox"/> No <input type="checkbox"/>
* CF3	Frequency-Hopping spread spectrum (FHSS) PHY for the 2.4 GHz band		O.2	Yes <input type="checkbox"/> No <input type="checkbox"/>
* CF4	Direct Sequence Spread Spectrum (DSSS) PHY for the 2.4 GHz band		O.2	Yes <input type="checkbox"/> No <input type="checkbox"/>
* CF5	Infrared PHY		O.2	Yes <input type="checkbox"/> No <input type="checkbox"/>

A.4.4 MAC protocol

A.4.4.1 MAC protocol capabilities

Item	Protocol capability	References	Status	Support
PC1	Are the following MAC protocol capabilities supported? Authentication service	5.4.3.1, 5.4.3.2, 5.7.6, 5.7.7, 8.1, Annex C	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC1.1	Authentication state	5.5	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC1.2	Open System authentication	8.1.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC1.3	Shared Key authentication	8.1.2, 8.3	PC2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
* PC2	WEP algorithm	5.4.3.3, 8.2, Annex C	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC2.1	WEP Encryption procedure	8.2.3, 8.2.4, 8.2.5	PC2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC2.2	WEP Decryption procedure	8.2.3, 8.2.4, 8.2.5	PC2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC2.3	Security services management	8.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC3	Distributed Coordination function	9.1, 9.2, Annex C	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC3.1	Net Allocation Vector (NAV) function	9.2.1, 9.2.5, 9.3.2.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC3.2	Interframe space usage and timing	9.2.3, 9.2.5, 9.2.10	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC3.3	Random Backoff function	9.2.4	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC3.4	DCF Access procedure	9.2.5.1, 9.2.5.5	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC3.5	Random Backoff procedure	9.2.5.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC3.6	Recovery procedures and retransmit limits	9.2.5.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC3.7	RTS/CTS procedure	9.2.5.4, 9.2.5.6, 9.2.5.7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>

A.4.4.1 MAC protocol capabilities (continued)

Item	Protocol capability	References	Status	Support
PC3.8	Directed MPDU transfer	9.2.6	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC3.9	Broadcast and multicast MPDU transfer	9.2.7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC3.10	MAC level acknowledgment	9.2.2, 9.2.8	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC3.11	Duplicate detection and recovery	9.2.9	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
* PC4	Point coordinator (PC)	9.1, 9.3, Annex C	CF1:O	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC4.1	Maintenance of CFP structure and timing	9.3.1, 9.3.2	PC4:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC4.2	PCF MPDU transfer from PC	9.3.3	PC4:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
* PC4.3	PCF MPDU transfer to PC	9.3.3	PC4:O	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC4.4	Overlapping PC provisions	9.3.3.2	PC4:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC4.5	Polling list maintenance	9.3.4	PC4.3: M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
* PC5	CF-Pollable	9.1, 9.3, Annex C	CF2:O	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC5.1	Interpretation of CFP structure and timing	9.3.1, 9.3.2	PC5:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC5.2	PCF MPDU transfer to/from and CF-Pollable STA	9.3.3	PC5:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC5.3	Polling list update	9.3.4	PC5:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC6	Fragmentation	9.2, 9.4, Annex C	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC7	Defragmentation	9.2, 9.5, Annex C	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC8	MAC data service	9.1.5, 9.8, Annex C	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC8.1	Reorderable-Multicast service class	9.8	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC8.2	StrictlyOrdered service class	9.8	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC9	Multirate support	9.6, Annex C	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
* PC10	Multiple outstanding MSDU support	9.8, Annex C	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC10.1	Multiple outstanding MSDU transmission restrictions	9.8	PC10:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC11	Timing synchronization	11.1, Annex C	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC11.1	Timing in an infrastructure network	11.1.1.1, 11.1.4	CF1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC11.2	Timing in an Independent BSS (IBSS)	11.1.1.2, 11.1.4	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC11.3	Beacon Generation function	11.1.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC11.5	TSF synchronization and accuracy	11.1.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC11.5	Infrastructure BSS initialization	11.1.3	CF1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

A.4.4.1 MAC protocol capabilities (continued)

Item	Protocol capability	References	Status	Support
PC11.6	Independent BSS initialization	11.1.3	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC11.7	Passive scanning	11.1.3	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC11.8	Active scanning	11.1.3	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC11.9	Probe response	11.1.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC11.10	Hop Synchronization function	11.1.5	CF3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC12	Infrastructure power management	11.2.1, Annex C	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC12.1	Station power management modes	11.2.1.1, 11.2.1.8	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC12.2	TIM transmission	11.2.1.2, 11.2.1.3	CF1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC12.3	AP function during CP	11.2.1.4	CF1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC12.4	AP function during CFP	11.2.1.5	PC4:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC12.5	Receive function during CP	11.2.1.6	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC12.6	Receive function during CFP	11.2.1.7	PC5:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC12.7	Aging function	11.2.1.9	CF1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC13	IBSS power management	11.2.2, Annex C	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC13.1	Initialization of power management	11.2.2.2	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC13.2	STA power state transitions	11.2.2.3	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC13.3	ATIM and frame transmission	11.2.2.4	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC14	Association and reassociation	5.4, 5.7, 11.3, Annex C	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC14.1	Association state	5.5	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC14.2	STA association procedure	11.3.1	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC14.3	AP association procedure	11.3.2	CF1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC14.4	STA reassociation procedure	11.3.3	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC14.5	AP reassociation procedure	11.3.4	CF1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC15	Management information base (MIB)	Annex D	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC15.1	dot11SMtbase, dot11SmtAuthenticationAlgorithms	Annex D	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
* PC15.2	dot11SMtprivacy	Annex D	PC2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PC15.3	dot11MACbase, dot11CountersGroup, dot11MacGroupAddresses	Annex D	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
* PC15.4	dot11MACStatistics	Annex D	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
PC15.5	dot11ResourceTypeID	Annex D	M	Yes <input type="checkbox"/> No <input type="checkbox"/>

A.4.4.2 MAC frames

Item	MAC frame	References	Status	Support
	Is transmission of the following MAC frames supported?	7, Annex C		
FT1	Association request	7	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT2	Association response	7	CF1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT3	Reassociation request	7	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT4	Reassociation response	7	CF1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT5	Probe request	7	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT6	Probe response	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FT7	Beacon	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FT8	ATIM	7	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT9	Disassociation	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FT10	Authentication	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FT11	Deauthentication	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FT12	PS-Poll	7	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT13	RTS	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FT14	CTS	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FT15	ACK	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FT16	CF-End	7	PC4:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT17	CF End+CF-Ack	7	PC4:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT18	Data	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FT19	Data + CF-Ack	7	(PC4 OR PC5):M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT20	Data + CF-Poll	7	PC4.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT21	Data + CF-Ack+CF-Poll	7	PC4.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT22	Null	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FT23	CF-Ack (no data)	7	(PC4 OR PC5):M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT24	CF-Poll (no data)	7	PC4.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FT25	CF-Ack+CF-Poll (no data)	7	PC4.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	Is reception of the following MAC frames supported?	7, Annex C		
FR1	Association request	7	CF1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FR2	Association response	7	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FR3	Reassociation request	7	CF1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FR4	Reassociation response	7	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FR5	Probe request	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR6	Probe response	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR7	Beacon	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR8	ATIM	7	CF2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FR9	Disassociation	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR10	Authentication	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>

A.4.4.2 MAC frames (continued)

Item	MAC frame	References	Status	Support
FR11	Deauthentication	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR12	PS-Poll	7	CF1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FR13	RTS	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR14	CTS	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR15	ACK	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR16	CF-End	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR17	CF End+CF-Ack	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR18	Data	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR19	Data + CF-Ack	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR20	Data + CF-Poll	7	PC5:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FR21	Data + CF-Ack+CF-Poll	7	PC5:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FR22	Null	7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FR23	CF-Ack (no data)	7	(PC4 OR PC5):M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FR24	CF-Poll (no data)	7	PC5:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FR25	CF-Ack+CF-Poll (no data)	7	PC5:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

A.4.4.3 Frame exchange sequences

Item	Frame exchange sequence	References	Status	Support
	Are the following frame sequences supported?			
FS1	Basic frame sequences	9.7, Annex C	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FS2	CF-Frame sequences	9.7, Annex C	(PC4 OR PC5):M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

A.4.4.4 MAC addressing functions

Item	MAC Address function	References	Status	Support
	Are the following MAC Addressing functions supported?			
AD1	STA universal individual IEEE 802 address	5.3.3, 7.1.3.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
AD2	BSS identifier generation	7.1.3.3, 11.1.3, Annex C	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
AD3	Receive address matching	7.1.3.3, 7.2.2, Annex C	M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

A.4.5 Frequency-Hopping PHY functions

Item	Protocol feature	References	Status	Support
	Which requirements and options does the PHY support?			
FH1	PHY service primitive parameters			
FH1.1	TXVECTOR parameter: LENGTH	14.2.2.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH1.2	TXVECTOR parameter: PLCPBITRATE	14.2.2.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH1.2.1	PLCPBITRATE = X'00' (1.0 Mbit/s)	14.2.2.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
* FH1.2.2	PLCPBITRATE = X'02' (2.0 Mbit/s)	14.2.2.2	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH1.3	RXVECTOR parameter: LENGTH	14.2.3.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH1.4	RXVECTOR parameter: RSSI	14.2.3.2	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH2	PLCP frame format			
FH2.1	PLCP Preamble: Sync	14.3.2.1.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH2.2	PLCP Preamble: Start Frame Delimiter	14.3.2.1.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH2.3	PLCP Header: Length Word	14.3.2.2.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH2.4	PLCP Header: Signaling field	14.3.2.2.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH2.5	PLCP Header: Header Error Check	14.3.2.2.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH2.6	PLCP Data Whitener: Scrambling and bias suppression encoding	14.3.2.3, 14.3.3.1.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH3	PLCP Transmit procedure			
FH3.1	Transmit: transmit on MAC request	14.3.3.1.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH3.2	Transmit: format and whiten frame	14.3.3.1.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH3.3	Transmit: Timing	14.3.3.1.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH4	PLCP CS/CCA procedure			
FH4.1	CS/CCA: perform on a minimum of one antenna	14.3.3.2.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH4.2	CS/CCA: Detect preamble starting up to 20 μ s after start of slot time	14.3.3.2.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH4.3	CS/CCA: Detect preamble starting at least 16 μ s prior to end of slot time	14.3.3.2.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH4.4	CS/CCA: Detect random data	14.3.3.2.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH4.5	CS/CCA: Perform on antenna with essentially same gain and pattern as transmit antenna	14.3.3.2.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH4.6	CS/CCA: Detect valid SFD and PLCP header	14.3.3.2.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH4.7	CS/CCA: Maintain BUSY indication until end of length contained in valid PLCP header	14.3.3.2.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH5	PLCP Receive procedure			
FH5.1	Receive: Receive and dewhiten frame	14.3.3.3.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH6	PHY LME			
FH6.1	PLME: Support FH sync	14.4.2.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH6.2	PLME: Support PLME primitives	14.4.3.2	O	Yes <input type="checkbox"/> No <input type="checkbox"/>

A.4.5 Frequency-Hopping PHY functions (continued)

Item	Protocol feature	References	Status	Support
FH7	Geographic area specific requirements			
* FH7.1	Geographic areas			
FH7.1.1	North America	14.6.2	O.1	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH7.1.2	Most of Europe	14.6.2	O.1	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH7.1.3	Japan	14.6.2	O.1	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH7.1.4	Spain	14.6.2	O.1	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH7.1.5	France	14.6.2	O.1	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH7.2	Operating frequency range	14.6.3	FH7.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH7.3	Number of operating channels	14.6.4	FH7.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH7.4	Operating channel frequencies	14.6.5	FH7.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH7.5	Occupied channel bandwidth	14.6.6	FH7.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH7.6	Minimum hop rate	14.6.7	FH7.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH7.7	Hop sequences	14.6.8	FH7.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH7.8	Unwanted emissions	14.6.9	FH7.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8	1 Mbit/s PMD			
FH8.1	Modulation 2GFSK, BT=0.5, 1=positive frequency deviation, 0=negative frequency deviation	14.6.10	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.2	Peak frequency deviation	14.6.10	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.3	Zero-Crossing error	14.6.10	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.4	Nominal channel data rate	14.6.11	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.5	Channel switching/settling time	14.6.12	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.6	Receive to transmit switch time	14.6.13	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.7	Nominal transmit power	14.6.14.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.8	Transmit power levels	14.6.14.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.9	Transmit power level control to <100 mW	14.6.14.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.10	Transmit spectrum shape	14.6.14.4	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.11	Transmit center frequency tolerance	14.6.14.5	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.12	Transmitter ramp periods	14.6.14.6	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.13	Receiver input dynamic range	14.6.15.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.14	Receiver center frequency acceptance range	14.6.15.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.15	Clear channel assessment power threshold for a probability of detection of 90% (preamble)/70% (random data) for 100 mW units	14.6.15.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.16	Clear channel assessment power threshold for units >100 mW; sensitivity threshold is 1/2 dB lower for every dB above 20 dBm	14.6.15.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.17	Minimum receiver sensitivity at FER=3% with 400 octet frames	14.6.15.4	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.18	Intermodulation protection	14.6.15.5	M	Yes <input type="checkbox"/> No <input type="checkbox"/>

A.4.5 Frequency-Hopping PHY functions (continued)

Item	Protocol feature	References	Status	Support
FH8.19	Desensitization	14.6.15.6	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.20	Operating temperature range	14.6.16	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.20.1	Temperature type 1	14.6.16	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.20.2	Temperature type 2	14.6.16	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH8.20.3	Temperature type 3	14.6.16	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH9	2 Mbit/s PMD			
FH9.1	All 1M PMD requirements	14.7.1	FH1.2.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FH9.2	Modulation 4GFSK, BT=0.5	14.7.2	FH1.2.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FH9.3	Frame structure for 2M PHY	14.7.2.1	FH1.2.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FH9.4	Nominal channel data rate	14.7.3	FH1.2.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FH9.5	Input dynamic range	14.7.4	FH1.2.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FH9.6	Minimum receiver sensitivity at FER=3% with 400 octet frames	14.7.5	FH1.2.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FH9.7	Intermodulation protection	14.7.6	FH1.2.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FH9.8	Desensitization	14.7.7	FH1.2.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
FH10	MIB	13.1, 14.8, Annex D	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
FH10.1	dot11PhyFHSSComplianceGroup, dot11PhyRegDomainsSupportGroup, and dot11PhyOperationComplianceGroup	13.1,14.8	M	Yes <input type="checkbox"/> No <input type="checkbox"/>

A.4.6 Direct sequence PHY functions

Item	PHY feature	References	Status	Support
DS1	PLCP sublayer procedures	15.2		
	Preamble prepend on TX	15.2.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS1.1	PLCP frame format	15.2.2, 15.2.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS1.2	PLCP integrity check generation	15.2.3, 15.2.3.6	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS1.3	TX rate change capability	15.2.3.3, 15.2.5	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS1.4	Supported data rates	15.1, 15.2.3.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS1.5	Data whitener scrambler	15.2.4	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS1.6	Scrambler initialization	15.2.4	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS2	Preamble process on RX	15.2.1		
DS2.1	PLCP frame format	15.2.2, 15.2.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS2.2	PLCP integrity check verify	15.2.3, 15.2.3.6	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS2.3	RX Rate change capability	15.2.3.3, 15.2.5	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS2.4	Data whitener descrambler	15.2.4	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS3	PN code sequence	15.4.6.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS4	Chipping continue on power down	15.2.6	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
*DS5	Operating channel capability	15.2.6, 15.4.6.2		

A.4.6 Direct sequence PHY functions (continued)

Item	PHY feature	References	Status	Support
* DS5.1	North America (FCC)	15.2.6, 15.4.6.2	DS5:O.1	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.1.1	channel 1	15.2.6, 15.4.6.2	DS5.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.1.2	channel 2	15.2.6, 15.4.6.2	DS5.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.1.3	channel 3	15.2.6, 15.4.6.2	DS5.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.1.4	channel 4	15.2.6, 15.4.6.2	DS5.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.1.5	channel 5	15.2.6, 15.4.6.2	DS5.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.1.6	channel 6	15.2.6, 15.4.6.2	DS5.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.1.7	channel 7	15.2.6, 15.4.6.2	DS5.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.1.8	channel 8	15.2.6, 15.4.6.2	DS5.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.1.9	channel 9	15.2.6, 15.4.6.2	DS5.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.1.10	channel 10	15.2.6, 15.4.6.2	DS5.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.1.11	channel 11	15.2.6, 15.4.6.2	DS5.1:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
* DS5.2	Canada (IC)	15.2.6, 15.4.6.2	DS5:O.1	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.2.1	channel 1	15.2.6, 15.4.6.2	DS5.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.2.2	channel 2	15.2.6, 15.4.6.2	DS5.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.2.3	channel 3	15.2.6, 15.4.6.2	DS5.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.2.4	channel 4	15.2.6, 15.4.6.2	DS5.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.2.5	channel 5	15.2.6, 15.4.6.2	DS5.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.2.6	channel 6	15.2.6, 15.4.6.2	DS5.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.2.7	channel 7	15.2.6, 15.4.6.2	DS5.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.2.8	channel 8	15.2.6, 15.4.6.2	DS5.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.2.9	channel 9	15.2.6, 15.4.6.2	DS5.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.2.10	channel 10	15.2.6, 15.4.6.2	DS5.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.2.11	channel 11	15.2.6, 15.4.6.2	DS5.2:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
* DS5.3	Europe (ETSI)	15.2.6, 15.4.6.2	DS5:O.1	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.1	channel 1	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.2	channel 2	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.3	channel 3	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.4	channel 4	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.5	channel 5	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.6	channel 6	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.7	channel 7	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.8	channel 8	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.9	channel 9	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.10	channel 10	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.11	channel 11	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.12	channel 12	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.3.13	channel 13	15.2.6, 15.4.6.2	DS5.3:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
* DS5.4	France	15.2.6, 15.4.6.2	DS5:O.1	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.4.1	channel 10	15.2.6, 15.4.6.2	DS5.4:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

A.4.6 Direct sequence PHY functions (continued)

Item	PHY feature	References	Status	Support
DS5.4.2	channel 11	15.2.6, 15.4.6.2	DS5.4:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.4.3	channel 12	15.2.6, 15.4.6.2	DS5.4:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.4.4	channel 13	15.2.6, 15.4.6.2	DS5.4:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
* DS5.5	Spain	15.2.6, 15.4.6.2	DS5:O.1	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.5.1	channel 10	15.2.6, 15.4.6.2	DS5.5:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS5.5.2	channel 11	15.2.6, 15.4.6.2	DS5.5:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
* DS5.6	Japan (RCR)	15.2.6, 15.4.6.2	DS5:O.1	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS6	Bits to symbol mapping	15.4.6.4		
DS6.1	1 Mbit/s	15.4.6.4	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS6.2	2 Mbit/s	15.4.6.4	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
*DS7	CCA functionality	15.4.8.4		
DS7.1	Energy Only (RSSI above threshold)	15.4.8.4	DS7:O.2	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS7.2	IEEE 802.11 DSSS correlation	15.4.8.4	DS7:O.2	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS7.3	Both methods	15.4.8.4	DS7:O.2	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS7.4	Hold CCA busy for packet duration of a correctly received PLCP but carrier lost during reception of MPDU	15.2.7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS7.5	Hold CCA busy for packet duration of a correctly received but out of specification PLCP	15.2.7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS8	Transmit antenna selection	15.4.5.5, 15.4.5.6	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS9	Receive antenna diversity	15.4.5.5, 15.4.5.6, 15.4.5.7	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
*DS10	Antenna port(s) availability	15.4.6.9	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS10.1	50 Ω impedance	15.4.6.9	DS10:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
*DS11	Transmit power level support	15.4.5.8, 15.4.7.3	O	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS11.1	If greater than 100 mW capability	15.4.7.3	DS11:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
*DS12	Radio type (temperature range)	15.4.6.10		
DS12.1	Type 1	15.4.6.10	DS12:O.3	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS12.2	Type 2	15.4.6.10	DS12:O.3	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
DS13	Spurious emissions conformance	15.4.6.5	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS14	TX-RX turnaround time	15.4.6.6	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS15	RX-TX turnaround time	15.4.6.7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS16	Slot time	15.4.6.8	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS17	ED reporting time	15.4.6.8, 15.4.8.4	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS18	Minimum transmit power level	15.4.7.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS19	Transmit spectral mask conformance	15.4.7.4	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS20	Transmitted center frequency tolerance	15.4.7.5	M	Yes <input type="checkbox"/> No <input type="checkbox"/>

A.4.6 Direct sequence PHY functions (continued)

Item	PHY feature	References	Status	Support
DS21	Chip clock frequency tolerance	15.4.7.6	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS22	Transmit power on ramp	15.4.7.7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS23	Transmit power down ramp	15.4.7.7	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS24	RF carrier suppression	15.4.7.8	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS25	Transmit modulation accuracy	15.4.7.9	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS26	Receiver minimum input level sensitivity	15.4.8.1	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS27	Receiver maximum input level	15.4.8.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS28	Receiver adjacent channel rejection	15.4.8.3	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS29	MIB	13.1, 15.3.2, Annex D	M	Yes <input type="checkbox"/> No <input type="checkbox"/>
DS29.1	dot11PhyDSSSComplianceGroup, dot11PhyRegDomainsSupportGroup, and dot11PhyOperationComplianceGroup	13.1, 15.3.2	M	Yes <input type="checkbox"/> No <input type="checkbox"/>

A.4.7 Infrared baseband PHY functions

Item	Feature	References	Status	Support
IR1	Is the transmitted SYNC field length in the range of required number of PPM slots, with the absence of a pulse in the last slot of the field?	16.2.4.1	M	Yes <input type="checkbox"/>
IR2	Is the transmitted SYNC field entirely populated by alternating presence and absence of pulses in consecutive PPM slots, with the absence of a pulse in the last slot of the field?	16.2.4.1	M	Yes <input type="checkbox"/>
IR3	Is the transmitted SFD field the binary sequence 1001, where 1 indicates a pulse in the PPM slot and 0 indicates no pulse in the PPM slot?	16.2.4.2	M	Yes <input type="checkbox"/>
IR4	Is the transmitted DR field pulse sequence equal to the correct value for the data rate provided by the TXVECTOR parameter PLCP BITRATE, where 1 indicates a pulse in the PPM slot and 0 indicates no pulse in the PPM slot?	16.2.4.3	M	Yes <input type="checkbox"/>
IR5	Is the transmitted DCLA field 32 PPM slots long with the specified sequence for 1 Mbit/s, where 1 indicates a pulse in the PPM slot and 0 indicates no pulse in the PPM slot? 1 Mbit/s: 00000000100000000000000010000000	16.2.4.4	M	Yes <input type="checkbox"/>
* IR5a	Does the unit support 2 Mbit/s transmission?	16.2.4.4	O	Yes <input type="checkbox"/> No <input type="checkbox"/>

A.4.7 Infrared baseband PHY functions (continued)

Item	Feature	References	Status	Support
IR5b	If the unit supports 2 Mbit/s transmission, is the transmitted DCLA field 32 PPM slots long with the specified sequence for 2 Mbit/s, where 1 indicates a pulse in the PPM slot and 0 indicates no pulse in the PPM slot? 2 Mbit/s: 0010001000100010001000100010	16.2.4.4	IR5a:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
IR6	Is the transmitted LENGTH field the correct PPM representation of the unsigned 16-bit binary integer, lsb transmitted first, equal to the correct value provided by the TXVECTOR parameter LENGTH?	16.2.4.5	M	Yes <input type="checkbox"/>
IR7	Is the transmitted CRC field the correct PPM representation of the CRC value calculated as per reference subclause, transmitted lsb first?	16.2.4.6	M	Yes <input type="checkbox"/>
IR8	Is the transmitted PSDU field the correct PPM representation of the PSDU, transmitted lsb first?	16.2.4.7	M	Yes <input type="checkbox"/>
IR9	When the CCA is false does transmission begin based on PHYTXSTART.request?	16.2.5.1	M	Yes <input type="checkbox"/>
IR10	Does the PHY issue a PHYTXSTART.confirm after the transmission of the PLCP header?	16.2.5.1	M	Yes <input type="checkbox"/>
IR11	Does the PHY accept each octet of the PSDU in a PHYDATA.request and answer with a PHYDATA.confirm?	16.2.5.1	M	Yes <input type="checkbox"/>
IR12	Does the PHY cease transmission in response to a PHYTXEND.request and answer with a PHYTXEND.confirm?	16.2.5.1	M	Yes <input type="checkbox"/>
IR13	Does the PHY of a receiving STA send a PHYCCA.indicate during reception of the SYNC field?	16.2.5.2	M	Yes <input type="checkbox"/>
IR14	Does the PHY of a receiving STA properly receive a transmission that changes data rate according to the DR field?	16.2.5.2	M	Yes <input type="checkbox"/>
IR15	Does the PHY of a receiving STA properly reject an incorrect CRC?	16.2.5.2	M	Yes <input type="checkbox"/>
IR16	Does the PHY of a receiving STA properly reject a DR field other than those specified in reference subclause?	16.2.5.2, 16.2.4.3	M	Yes <input type="checkbox"/>
IR17	Does the PHY of a receiving STA send PHYRXSTART.indicate with correct RATE and LENGTH parameters after proper reception of PLCP preamble and PLCP header?	16.2.5.2	M	Yes <input type="checkbox"/>
IR18	Does the PHY of a receiving STA forward receive octets in PHYDATA.indicate primitives?	16.2.5.2	M	Yes <input type="checkbox"/>
IR19	Does the PHY of a receiving STA send a PHYRXEND.indicate after the final octet indicated by the LENGTH field?	16.2.5.2	M	Yes <input type="checkbox"/>

A.4.7 Infrared baseband PHY functions (continued)

Item	Feature	References	Status	Support
IR20	Does the PHY of a receiving STA send a PHYCCA.indicate with a state value of IDLE after the PHYRXEND.indicate?	16.2.5.2	M	Yes <input type="checkbox"/>
IR21	Does the PHY reset its CCA detection mechanism upon receiving a PHYCARST.request, and respond with a PHYCCARST.indicate?	16.2.5.3	M	Yes <input type="checkbox"/>
IR22	When transmitting at 1 Mbit/s does the PHY transmit PPM symbols according to the 16-PPM Basic Rate Mapping table, transmitting from left to right?	16.3.2.1, 16.3.2.2	M	Yes <input type="checkbox"/>
IR23	When transmitting at 2 Mbit/s does the PHY transmit PPM symbols according to the 4-PPM Enhanced Rate Mapping table, transmitting from left to right?	16.3.2.1, 16.3.2.2	IR5a:M	Yes <input type="checkbox"/>
IR24	Does the PHY operate over a temperature range of 0 °C to 40 °C?	16.3.2.4	M	Yes <input type="checkbox"/>
* IR25	If the unit is conformant to emitter radiation mask 1, is the peak optical power of an emitted pulse within the specification range averaged over the pulse width?	16.3.3.1	O.1	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
* IR26	If the unit is conformant to emitter radiation mask 2, is the peak optical power of an emitted pulse within the specification range averaged over the pulse width?	16.3.3.1	O.1	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
IR27	Does the transmitted pulse shape conform to the description of the reference subclause?	16.3.3.2	M	Yes <input type="checkbox"/>
IR28	Does the emitter radiation pattern as a function of angle conform to the requirements of the reference subclause as applicable based on conformance to emitter radiation mask 1?	16.3.3.3	IR25:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
IR28a	Does the emitter radiation pattern as a function of angle conform to the requirements of the reference subclause as applicable based on conformance to emitter radiation mask 2?	16.3.3.3	IR26:M	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
IR29	Is the peak emitter optical output as a function of wavelength in the range specified?	16.3.3.4	M	Yes <input type="checkbox"/>
IR30	Does the spectrum of the transmit signal amplitude as a voltage or current meet the requirements of the reference subclause?	16.3.3.5	M	Yes <input type="checkbox"/>
IR31	Does the receiver sensitivity meet the requirements of the reference subclause for receive signals of both 1 Mbit/s and 2 Mbit/s?	16.3.4.1	M	Yes <input type="checkbox"/>
IR32	Does the receiver exhibit a dynamic range as specified in reference subclause?	16.3.4.2	M	Yes <input type="checkbox"/>
IR33	Does the receiver field-of-view conform to the requirements of the reference subclause?	16.3.4.3	M	Yes <input type="checkbox"/>
IR34	When it is known that the conditions are such that the Carrier Detect Signal and the Energy Detect Signal are false is the CCA asserted IDLE?	16.3.5.1	M	Yes <input type="checkbox"/>

A.4.7 Infrared baseband PHY functions (continued)

Item	Feature	References	Status	Support
IR35	When the conditions are such that Energy Detect is true for greater than the time defined in reference subclause, does CCA become IDLE?	16.3.5.1	M	Yes <input type="checkbox"/>
IR36	When conditions are such that either Carrier Detect or Energy Detect go true, does CCA go BUSY?	16.3.5.1	M	Yes <input type="checkbox"/>
IR37	Are these compliance groups implemented? dot11PhyIRComplianceGroup, dot11PhyRegDomainsSupportGroup, and dot11PhyOperationComplianceGroup	16.4	M	Yes <input type="checkbox"/>

Annex B

(informative)

Hopping sequences

The following tables pertain to the hopping sequences for North America and ETSI.

Table B.1—Hopping sequence set 1

index	0	3	6	9	12	15	18	21	24	27	30	33	36
1	2	5	8	11	14	17	20	23	26	29	32	35	38
2	25	28	31	34	37	40	43	46	49	52	55	58	61
3	64	67	70	73	76	79	3	6	9	12	15	18	21
4	10	13	16	19	22	25	28	31	34	37	40	43	46
5	45	48	51	54	57	60	63	66	69	72	75	78	2
6	18	21	24	27	30	33	36	39	42	45	48	51	54
7	73	76	79	3	6	9	12	15	18	21	24	27	30
8	49	52	55	58	61	64	67	70	73	76	79	3	6
9	21	24	27	30	33	36	39	42	45	48	51	54	57
10	63	66	69	72	75	78	2	5	8	11	14	17	20
11	78	2	5	8	11	14	17	20	23	26	29	32	35
12	31	34	37	40	43	46	49	52	55	58	61	64	67
13	61	64	67	70	73	76	79	3	6	9	12	15	18
14	24	27	30	33	36	39	42	45	48	51	54	57	60
15	54	57	60	63	66	69	72	75	78	2	5	8	11
16	65	68	71	74	77	80	4	7	10	13	16	19	22
17	28	31	34	37	40	43	46	49	52	55	58	61	64
18	79	3	6	9	12	15	18	21	24	27	30	33	36
19	33	36	39	42	45	48	51	54	57	60	63	66	69
20	4	7	10	13	16	19	22	25	28	31	34	37	40
21	20	23	26	29	32	35	38	41	44	47	50	53	56
22	13	16	19	22	25	28	31	34	37	40	43	46	49
23	38	41	44	47	50	53	56	59	62	65	68	71	74
24	74	77	80	4	7	10	13	16	19	22	25	28	31
25	56	59	62	65	68	71	74	77	80	4	7	10	13
26	71	74	77	80	4	7	10	13	16	19	22	25	28
27	23	26	29	32	35	38	41	44	47	50	53	56	59
28	5	8	11	14	17	20	23	26	29	32	35	38	41
29	39	42	45	48	51	54	57	60	63	66	69	72	75
30	12	15	18	21	24	27	30	33	36	39	42	45	48
31	36	39	42	45	48	51	54	57	60	63	66	69	72
32	68	71	74	77	80	4	7	10	13	16	19	22	25
33	9	12	15	18	21	24	27	30	33	36	39	42	45
34	70	73	76	79	3	6	9	12	15	18	21	24	27
35	77	80	4	7	10	13	16	19	22	25	28	31	34
36	6	9	12	15	18	21	24	27	30	33	36	39	42
37	62	65	68	71	74	77	80	4	7	10	13	16	19
38	29	32	35	38	41	44	47	50	53	56	59	62	65
39	14	17	20	23	26	29	32	35	38	41	44	47	50

Table B.1—Hopping sequence set 1 (continued)

index	0	3	6	9	12	15	18	21	24	27	30	33	36
40	27	30	33	36	39	42	45	48	51	54	57	60	63
41	16	19	22	25	28	31	34	37	40	43	46	49	52
42	59	62	65	68	71	74	77	80	4	7	10	13	16
43	43	46	49	52	55	58	61	64	67	70	73	76	79
44	76	79	3	6	9	12	15	18	21	24	27	30	33
45	34	37	40	43	46	49	52	55	58	61	64	67	70
46	72	75	78	2	5	8	11	14	17	20	23	26	29
47	11	14	17	20	23	26	29	32	35	38	41	44	47
48	60	63	66	69	72	75	78	2	5	8	11	14	17
49	80	4	7	10	13	16	19	22	25	28	31	34	37
50	47	50	53	56	59	62	65	68	71	74	77	80	4
51	22	25	28	31	34	37	40	43	46	49	52	55	58
52	75	78	2	5	8	11	14	17	20	23	26	29	32
53	66	69	72	75	78	2	5	8	11	14	17	20	23
54	41	44	47	50	53	56	59	62	65	68	71	74	77
55	15	18	21	24	27	30	33	36	39	42	45	48	51
56	35	38	41	44	47	50	53	56	59	62	65	68	71
57	67	70	73	76	79	3	6	9	12	15	18	21	24
58	52	55	58	61	64	67	70	73	76	79	3	6	9
59	58	61	64	67	70	73	76	79	3	6	9	12	15
60	44	47	50	53	56	59	62	65	68	71	74	77	80
61	50	53	56	59	62	65	68	71	74	77	80	4	7
62	17	20	23	26	29	32	35	38	41	44	47	50	53
63	7	10	13	16	19	22	25	28	31	34	37	40	43
64	19	22	25	28	31	34	37	40	43	46	49	52	55
65	8	11	14	17	20	23	26	29	32	35	38	41	44
66	69	72	75	78	2	5	8	11	14	17	20	23	26
67	51	54	57	60	63	66	69	72	75	78	2	5	8
68	42	45	48	51	54	57	60	63	66	69	72	75	78
69	3	6	9	12	15	18	21	24	27	30	33	36	39
70	30	33	36	39	42	45	48	51	54	57	60	63	66
71	57	60	63	66	69	72	75	78	2	5	8	11	14
72	37	40	43	46	49	52	55	58	61	64	67	70	73
73	55	58	61	64	67	70	73	76	79	3	6	9	12
74	26	29	32	35	38	41	44	47	50	53	56	59	62
75	46	49	52	55	58	61	64	67	70	73	76	79	3
76	53	56	59	62	65	68	71	74	77	80	4	7	10
77	40	43	46	49	52	55	58	61	64	67	70	73	76
78	32	35	38	41	44	47	50	53	56	59	62	65	68
79	48	51	54	57	60	63	66	69	72	75	78	2	5

Table B.1—Hopping sequence set 1 (continued)

index	39	42	45	48	51	54	57	60	63	66	69	72	75
1	41	44	47	50	53	56	59	62	65	68	71	74	77
2	64	67	70	73	76	79	3	6	9	12	15	18	21
3	24	27	30	33	36	39	42	45	48	51	54	57	60
4	49	52	55	58	61	64	67	70	73	76	79	3	6
5	5	8	11	14	17	20	23	26	29	32	35	38	41
6	57	60	63	66	69	72	75	78	2	5	8	11	14
7	33	36	39	42	45	48	51	54	57	60	63	66	69
8	9	12	15	18	21	24	27	30	33	36	39	42	45
9	60	63	66	69	72	75	78	2	5	8	11	14	17
10	23	26	29	32	35	38	41	44	47	50	53	56	59
11	38	41	44	47	50	53	56	59	62	65	68	71	74
12	70	73	76	79	3	6	9	12	15	18	21	24	27
13	21	24	27	30	33	36	39	42	45	48	51	54	57
14	63	66	69	72	75	78	2	5	8	11	14	17	20
15	14	17	20	23	26	29	32	35	38	41	44	47	50
16	25	28	31	34	37	40	43	46	49	52	55	58	61
17	67	70	73	76	79	3	6	9	12	15	18	21	24
18	39	42	45	48	51	54	57	60	63	66	69	72	75
19	72	75	78	2	5	8	11	14	17	20	23	26	29
20	43	46	49	52	55	58	61	64	67	70	73	76	79
21	59	62	65	68	71	74	77	80	4	7	10	13	16
22	52	55	58	61	64	67	70	73	76	79	3	6	9
23	77	80	4	7	10	13	16	19	22	25	28	31	34
24	34	37	40	43	46	49	52	55	58	61	64	67	70
25	16	19	22	25	28	31	34	37	40	43	46	49	52
26	31	34	37	40	43	46	49	52	55	58	61	64	67
27	62	65	68	71	74	77	80	4	7	10	13	16	19
28	44	47	50	53	56	59	62	65	68	71	74	77	80
29	78	2	5	8	11	14	17	20	23	26	29	32	35
30	51	54	57	60	63	66	69	72	75	78	2	5	8
31	75	78	2	5	8	11	14	17	20	23	26	29	32
32	28	31	34	37	40	43	46	49	52	55	58	61	64
33	48	51	54	57	60	63	66	69	72	75	78	2	5
34	30	33	36	39	42	45	48	51	54	57	60	63	66
35	37	40	43	46	49	52	55	58	61	64	67	70	73
36	45	48	51	54	57	60	63	66	69	72	75	78	2
37	22	25	28	31	34	37	40	43	46	49	52	55	58
38	68	71	74	77	80	4	7	10	13	16	19	22	25
39	53	56	59	62	65	68	71	74	77	80	4	7	10

Table B.1—Hopping sequence set 1 (continued)

index	39	42	45	48	51	54	57	60	63	66	69	72	75
40	66	69	72	75	78	2	5	8	11	14	17	20	23
41	55	58	61	64	67	70	73	76	79	3	6	9	12
42	19	22	25	28	31	34	37	40	43	46	49	52	55
43	3	6	9	12	15	18	21	24	27	30	33	36	39
44	36	39	42	45	48	51	54	57	60	63	66	69	72
45	73	76	79	3	6	9	12	15	18	21	24	27	30
46	32	35	38	41	44	47	50	53	56	59	62	65	68
47	50	53	56	59	62	65	68	71	74	77	80	4	7
48	20	23	26	29	32	35	38	41	44	47	50	53	56
49	40	43	46	49	52	55	58	61	64	67	70	73	76
50	7	10	13	16	19	22	25	28	31	34	37	40	43
51	61	64	67	70	73	76	79	3	6	9	12	15	18
52	35	38	41	44	47	50	53	56	59	62	65	68	71
53	26	29	32	35	38	41	44	47	50	53	56	59	62
54	80	4	7	10	13	16	19	22	25	28	31	34	37
55	54	57	60	63	66	69	72	75	78	2	5	8	11
56	74	77	80	4	7	10	13	16	19	22	25	28	31
57	27	30	33	36	39	42	45	48	51	54	57	60	63
58	12	15	18	21	24	27	30	33	36	39	42	45	48
59	18	21	24	27	30	33	36	39	42	45	48	51	54
60	4	7	10	13	16	19	22	25	28	31	34	37	40
61	10	13	16	19	22	25	28	31	34	37	40	43	46
62	56	59	62	65	68	71	74	77	80	4	7	10	13
63	46	49	52	55	58	61	64	67	70	73	76	79	3
64	58	61	64	67	70	73	76	79	3	6	9	12	15
65	47	50	53	56	59	62	65	68	71	74	77	80	4
66	29	32	35	38	41	44	47	50	53	56	59	62	65
67	11	14	17	20	23	26	29	32	35	38	41	44	47
68	2	5	8	11	14	17	20	23	26	29	32	35	38
69	42	45	48	51	54	57	60	63	66	69	72	75	78
70	69	72	75	78	2	5	8	11	14	17	20	23	26
71	17	20	23	26	29	32	35	38	41	44	47	50	53
72	76	79	3	6	9	12	15	18	21	24	27	30	33
73	15	18	21	24	27	30	33	36	39	42	45	48	51
74	65	68	71	74	77	80	4	7	10	13	16	19	22
75	6	9	12	15	18	21	24	27	30	33	36	39	42
76	13	16	19	22	25	28	31	34	37	40	43	46	49
77	79	3	6	9	12	15	18	21	24	27	30	33	36
78	71	74	77	80	4	7	10	13	16	19	22	25	28
79	8	11	14	17	20	23	26	29	32	35	38	41	44

Table B.2—Hopping sequence set 2

index	1	4	7	10	13	16	19	22	25	28	31	34	37
1	3	6	9	12	15	18	21	24	27	30	33	36	39
2	26	29	32	35	38	41	44	47	50	53	56	59	62
3	65	68	71	74	77	80	4	7	10	13	16	19	22
4	11	14	17	20	23	26	29	32	35	38	41	44	47
5	46	49	52	55	58	61	64	67	70	73	76	79	3
6	19	22	25	28	31	34	37	40	43	46	49	52	55
7	74	77	80	4	7	10	13	16	19	22	25	28	31
8	50	53	56	59	62	65	68	71	74	77	80	4	7
9	22	25	28	31	34	37	40	43	46	49	52	55	58
10	64	67	70	73	76	79	3	6	9	12	15	18	21
11	79	3	6	9	12	15	18	21	24	27	30	33	36
12	32	35	38	41	44	47	50	53	56	59	62	65	68
13	62	65	68	71	74	77	80	4	7	10	13	16	19
14	25	28	31	34	37	40	43	46	49	52	55	58	61
15	55	58	61	64	67	70	73	76	79	3	6	9	12
16	66	69	72	75	78	2	5	8	11	14	17	20	23
17	29	32	35	38	41	44	47	50	53	56	59	62	65
18	80	4	7	10	13	16	19	22	25	28	31	34	37
19	34	37	40	43	46	49	52	55	58	61	64	67	70
20	5	8	11	14	17	20	23	26	29	32	35	38	41
21	21	24	27	30	33	36	39	42	45	48	51	54	57
22	14	17	20	23	26	29	32	35	38	41	44	47	50
23	39	42	45	48	51	54	57	60	63	66	69	72	75
24	75	78	2	5	8	11	14	17	20	23	26	29	32
25	57	60	63	66	69	72	75	78	2	5	8	11	14
26	72	75	78	2	5	8	11	14	17	20	23	26	29
27	24	27	30	33	36	39	42	45	48	51	54	57	60
28	6	9	12	15	18	21	24	27	30	33	36	39	42
29	40	43	46	49	52	55	58	61	64	67	70	73	76
30	13	16	19	22	25	28	31	34	37	40	43	46	49
31	37	40	43	46	49	52	55	58	61	64	67	70	73
32	69	72	75	78	2	5	8	11	14	17	20	23	26
33	10	13	16	19	22	25	28	31	34	37	40	43	46
34	71	74	77	80	4	7	10	13	16	19	22	25	28
35	78	2	5	8	11	14	17	20	23	26	29	32	35
36	7	10	13	16	19	22	25	28	31	34	37	40	43
37	63	66	69	72	75	78	2	5	8	11	14	17	20
38	30	33	36	39	42	45	48	51	54	57	60	63	66
39	15	18	21	24	27	30	33	36	39	42	45	48	51

Table B.2—Hopping sequence set 2 (continued)

index	1	4	7	10	13	16	19	22	25	28	31	34	37
40	28	31	34	37	40	43	46	49	52	55	58	61	64
41	17	20	23	26	29	32	35	38	41	44	47	50	53
42	60	63	66	69	72	75	78	2	5	8	11	14	17
43	44	47	50	53	56	59	62	65	68	71	74	77	80
44	77	80	4	7	10	13	16	19	22	25	28	31	34
45	35	38	41	44	47	50	53	56	59	62	65	68	71
46	73	76	79	3	6	9	12	15	18	21	24	27	30
47	12	15	18	21	24	27	30	33	36	39	42	45	48
48	61	64	67	70	73	76	79	3	6	9	12	15	18
49	2	5	8	11	14	17	20	23	26	29	32	35	38
50	48	51	54	57	60	63	66	69	72	75	78	2	5
51	23	26	29	32	35	38	41	44	47	50	53	56	59
52	76	79	3	6	9	12	15	18	21	24	27	30	33
53	67	70	73	76	79	3	6	9	12	15	18	21	24
54	42	45	48	51	54	57	60	63	66	69	72	75	78
55	16	19	22	25	28	31	34	37	40	43	46	49	52
56	36	39	42	45	48	51	54	57	60	63	66	69	72
57	68	71	74	77	80	4	7	10	13	16	19	22	25
58	53	56	59	62	65	68	71	74	77	80	4	7	10
59	59	62	65	68	71	74	77	80	4	7	10	13	16
60	45	48	51	54	57	60	63	66	69	72	75	78	2
61	51	54	57	60	63	66	69	72	75	78	2	5	8
62	18	21	24	27	30	33	36	39	42	45	48	51	54
63	8	11	14	17	20	23	26	29	32	35	38	41	44
64	20	23	26	29	32	35	38	41	44	47	50	53	56
65	9	12	15	18	21	24	27	30	33	36	39	42	45
66	70	73	76	79	3	6	9	12	15	18	21	24	27
67	52	55	58	61	64	67	70	73	76	79	3	6	9
68	43	46	49	52	55	58	61	64	67	70	73	76	79
69	4	7	10	13	16	19	22	25	28	31	34	37	40
70	31	34	37	40	43	46	49	52	55	58	61	64	67
71	58	61	64	67	70	73	76	79	3	6	9	12	15
72	38	41	44	47	50	53	56	59	62	65	68	71	74
73	56	59	62	65	68	71	74	77	80	4	7	10	13
74	27	30	33	36	39	42	45	48	51	54	57	60	63
75	47	50	53	56	59	62	65	68	71	74	77	80	4
76	54	57	60	63	66	69	72	75	78	2	5	8	11
77	41	44	47	50	53	56	59	62	65	68	71	74	77
78	33	36	39	42	45	48	51	54	57	60	63	66	69
79	49	52	55	58	61	64	67	70	73	76	79	3	6

Table B.2—Hopping sequence set 2 (continued)

index	40	43	46	49	52	55	58	61	64	67	70	73	76
1	42	45	48	51	54	57	60	63	66	69	72	75	78
2	65	68	71	74	77	80	4	7	10	13	16	19	22
3	25	28	31	34	37	40	43	46	49	52	55	58	61
4	50	53	56	59	62	65	68	71	74	77	80	4	7
5	6	9	12	15	18	21	24	27	30	33	36	39	42
6	58	61	64	67	70	73	76	79	3	6	9	12	15
7	34	37	40	43	46	49	52	55	58	61	64	67	70
8	10	13	16	19	22	25	28	31	34	37	40	43	46
9	61	64	67	70	73	76	79	3	6	9	12	15	18
10	24	27	30	33	36	39	42	45	48	51	54	57	60
11	39	42	45	48	51	54	57	60	63	66	69	72	75
12	71	74	77	80	4	7	10	13	16	19	22	25	28
13	22	25	28	31	34	37	40	43	46	49	52	55	58
14	64	67	70	73	76	79	3	6	9	12	15	18	21
15	15	18	21	24	27	30	33	36	39	42	45	48	51
16	26	29	32	35	38	41	44	47	50	53	56	59	62
17	68	71	74	77	80	4	7	10	13	16	19	22	25
18	40	43	46	49	52	55	58	61	64	67	70	73	76
19	73	76	79	3	6	9	12	15	18	21	24	27	30
20	44	47	50	53	56	59	62	65	68	71	74	77	80
21	60	63	66	69	72	75	78	2	5	8	11	14	17
22	53	56	59	62	65	68	71	74	77	80	4	7	10
23	78	2	5	8	11	14	17	20	23	26	29	32	35
24	35	38	41	44	47	50	53	56	59	62	65	68	71
25	17	20	23	26	29	32	35	38	41	44	47	50	53
26	32	35	38	41	44	47	50	53	56	59	62	65	68
27	63	66	69	72	75	78	2	5	8	11	14	17	20
28	45	48	51	54	57	60	63	66	69	72	75	78	2
29	79	3	6	9	12	15	18	21	24	27	30	33	36
30	52	55	58	61	64	67	70	73	76	79	3	6	9
31	76	79	3	6	9	12	15	18	21	24	27	30	33
32	29	32	35	38	41	44	47	50	53	56	59	62	65
33	49	52	55	58	61	64	67	70	73	76	79	3	6
34	31	34	37	40	43	46	49	52	55	58	61	64	67
35	38	41	44	47	50	53	56	59	62	65	68	71	74
36	46	49	52	55	58	61	64	67	70	73	76	79	3
37	23	26	29	32	35	38	41	44	47	50	53	56	59
38	69	72	75	78	2	5	8	11	14	17	20	23	26
39	54	57	60	63	66	69	72	75	78	2	5	8	11

Table B.2—Hopping sequence set 2 (continued)

index	40	43	46	49	52	55	58	61	64	67	70	73	76
40	67	70	73	76	79	3	6	9	12	15	18	21	24
41	56	59	62	65	68	71	74	77	80	4	7	10	13
42	20	23	26	29	32	35	38	41	44	47	50	53	56
43	4	7	10	13	16	19	22	25	28	31	34	37	40
44	37	40	43	46	49	52	55	58	61	64	67	70	73
45	74	77	80	4	7	10	13	16	19	22	25	28	31
46	33	36	39	42	45	48	51	54	57	60	63	66	69
47	51	54	57	60	63	66	69	72	75	78	2	5	8
48	21	24	27	30	33	36	39	42	45	48	51	54	57
49	41	44	47	50	53	56	59	62	65	68	71	74	77
50	8	11	14	17	20	23	26	29	32	35	38	41	44
51	62	65	68	71	74	77	80	4	7	10	13	16	19
52	36	39	42	45	48	51	54	57	60	63	66	69	72
53	27	30	33	36	39	42	45	48	51	54	57	60	63
54	2	5	8	11	14	17	20	23	26	29	32	35	38
55	55	58	61	64	67	70	73	76	79	3	6	9	12
56	75	78	2	5	8	11	14	17	20	23	26	29	32
57	28	31	34	37	40	43	46	49	52	55	58	61	64
58	13	16	19	22	25	28	31	34	37	40	43	46	49
59	19	22	25	28	31	34	37	40	43	46	49	52	55
60	5	8	11	14	17	20	23	26	29	32	35	38	41
61	11	14	17	20	23	26	29	32	35	38	41	44	47
62	57	60	63	66	69	72	75	78	2	5	8	11	14
63	47	50	53	56	59	62	65	68	71	74	77	80	4
64	59	62	65	68	71	74	77	80	4	7	10	13	16
65	48	51	54	57	60	63	66	69	72	75	78	2	5
66	30	33	36	39	42	45	48	51	54	57	60	63	66
67	12	15	18	21	24	27	30	33	36	39	42	45	48
68	3	6	9	12	15	18	21	24	27	30	33	36	39
69	43	46	49	52	55	58	61	64	67	70	73	76	79
70	70	73	76	79	3	6	9	12	15	18	21	24	27
71	18	21	24	27	30	33	36	39	42	45	48	51	54
72	77	80	4	7	10	13	16	19	22	25	28	31	34
73	16	19	22	25	28	31	34	37	40	43	46	49	52
74	66	69	72	75	78	2	5	8	11	14	17	20	23
75	7	10	13	16	19	22	25	28	31	34	37	40	43
76	14	17	20	23	26	29	32	35	38	41	44	47	50
77	80	4	7	10	13	16	19	22	25	28	31	34	37
78	72	75	78	2	5	8	11	14	17	20	23	26	29
79	9	12	15	18	21	24	27	30	33	36	39	42	45

Table B.3—Hopping sequence set 3

index	2	5	8	11	14	17	20	23	26	29	32	35	38
1	4	7	10	13	16	19	22	25	28	31	34	37	40
2	27	30	33	36	39	42	45	48	51	54	57	60	63
3	66	69	72	75	78	2	5	8	11	14	17	20	23
4	12	15	18	21	24	27	30	33	36	39	42	45	48
5	47	50	53	56	59	62	65	68	71	74	77	80	4
6	20	23	26	29	32	35	38	41	44	47	50	53	56
7	75	78	2	5	8	11	14	17	20	23	26	29	32
8	51	54	57	60	63	66	69	72	75	78	2	5	8
9	23	26	29	32	35	38	41	44	47	50	53	56	59
10	65	68	71	74	77	80	4	7	10	13	16	19	22
11	80	4	7	10	13	16	19	22	25	28	31	34	37
12	33	36	39	42	45	48	51	54	57	60	63	66	69
13	63	66	69	72	75	78	2	5	8	11	14	17	20
14	26	29	32	35	38	41	44	47	50	53	56	59	62
15	56	59	62	65	68	71	74	77	80	4	7	10	13
16	67	70	73	76	79	3	6	9	12	15	18	21	24
17	30	33	36	39	42	45	48	51	54	57	60	63	66
18	2	5	8	11	14	17	20	23	26	29	32	35	38
19	35	38	41	44	47	50	53	56	59	62	65	68	71
20	6	9	12	15	18	21	24	27	30	33	36	39	42
21	22	25	28	31	34	37	40	43	46	49	52	55	58
22	15	18	21	24	27	30	33	36	39	42	45	48	51
23	40	43	46	49	52	55	58	61	64	67	70	73	76
24	76	79	3	6	9	12	15	18	21	24	27	30	33
25	58	61	64	67	70	73	76	79	3	6	9	12	15
26	73	76	79	3	6	9	12	15	18	21	24	27	30
27	25	28	31	34	37	40	43	46	49	52	55	58	61
28	7	10	13	16	19	22	25	28	31	34	37	40	43
29	41	44	47	50	53	56	59	62	65	68	71	74	77
30	14	17	20	23	26	29	32	35	38	41	44	47	50
31	38	41	44	47	50	53	56	59	62	65	68	71	74
32	70	73	76	79	3	6	9	12	15	18	21	24	27
33	11	14	17	20	23	26	29	32	35	38	41	44	47
34	72	75	78	2	5	8	11	14	17	20	23	26	29
35	79	3	6	9	12	15	18	21	24	27	30	33	36
36	8	11	14	17	20	23	26	29	32	35	38	41	44
37	64	67	70	73	76	79	3	6	9	12	15	18	21
38	31	34	37	40	43	46	49	52	55	58	61	64	67
39	16	19	22	25	28	31	34	37	40	43	46	49	52

Table B.3—Hopping sequence set 3 (continued)

index	2	5	8	11	14	17	20	23	26	29	32	35	38
40	29	32	35	38	41	44	47	50	53	56	59	62	65
41	18	21	24	27	30	33	36	39	42	45	48	51	54
42	61	64	67	70	73	76	79	3	6	9	12	15	18
43	45	48	51	54	57	60	63	66	69	72	75	78	2
44	78	2	5	8	11	14	17	20	23	26	29	32	35
45	36	39	42	45	48	51	54	57	60	63	66	69	72
46	74	77	80	4	7	10	13	16	19	22	25	28	31
47	13	16	19	22	25	28	31	34	37	40	43	46	49
48	62	65	68	71	74	77	80	4	7	10	13	16	19
49	3	6	9	12	15	18	21	24	27	30	33	36	39
50	49	52	55	58	61	64	67	70	73	76	79	3	6
51	24	27	30	33	36	39	42	45	48	51	54	57	60
52	77	80	4	7	10	13	16	19	22	25	28	31	34
53	68	71	74	77	80	4	7	10	13	16	19	22	25
54	43	46	49	52	55	58	61	64	67	70	73	76	79
55	17	20	23	26	29	32	35	38	41	44	47	50	53
56	37	40	43	46	49	52	55	58	61	64	67	70	73
57	69	72	75	78	2	5	8	11	14	17	20	23	26
58	54	57	60	63	66	69	72	75	78	2	5	8	11
59	60	63	66	69	72	75	78	2	5	8	11	14	17
60	46	49	52	55	58	61	64	67	70	73	76	79	3
61	52	55	58	61	64	67	70	73	76	79	3	6	9
62	19	22	25	28	31	34	37	40	43	46	49	52	55
63	9	12	15	18	21	24	27	30	33	36	39	42	45
64	21	24	27	30	33	36	39	42	45	48	51	54	57
65	10	13	16	19	22	25	28	31	34	37	40	43	46
66	71	74	77	80	4	7	10	13	16	19	22	25	28
67	53	56	59	62	65	68	71	74	77	80	4	7	10
68	44	47	50	53	56	59	62	65	68	71	74	77	80
69	5	8	11	14	17	20	23	26	29	32	35	38	41
70	32	35	38	41	44	47	50	53	56	59	62	65	68
71	59	62	65	68	71	74	77	80	4	7	10	13	16
72	39	42	45	48	51	54	57	60	63	66	69	72	75
73	57	60	63	66	69	72	75	78	2	5	8	11	14
74	28	31	34	37	40	43	46	49	52	55	58	61	64
75	48	51	54	57	60	63	66	69	72	75	78	2	5
76	55	58	61	64	67	70	73	76	79	3	6	9	12
77	42	45	48	51	54	57	60	63	66	69	72	75	78
78	34	37	40	43	46	49	52	55	58	61	64	67	70
79	50	53	56	59	62	65	68	71	74	77	80	4	7

Table B.3—Hopping sequence set 3 (continued)

index	41	44	47	50	53	56	59	62	65	68	71	74	77
1	43	46	49	52	55	58	61	64	67	70	73	76	79
2	66	69	72	75	78	2	5	8	11	14	17	20	23
3	26	29	32	35	38	41	44	47	50	53	56	59	62
4	51	54	57	60	63	66	69	72	75	78	2	5	8
5	7	10	13	16	19	22	25	28	31	34	37	40	43
6	59	62	65	68	71	74	77	80	4	7	10	13	16
7	35	38	41	44	47	50	53	56	59	62	65	68	71
8	11	14	17	20	23	26	29	32	35	38	41	44	47
9	62	65	68	71	74	77	80	4	7	10	13	16	19
10	25	28	31	34	37	40	43	46	49	52	55	58	61
11	40	43	46	49	52	55	58	61	64	67	70	73	76
12	72	75	78	2	5	8	11	14	17	20	23	26	29
13	23	26	29	32	35	38	41	44	47	50	53	56	59
14	65	68	71	74	77	80	4	7	10	13	16	19	22
15	16	19	22	25	28	31	34	37	40	43	46	49	52
16	27	30	33	36	39	42	45	48	51	54	57	60	63
17	69	72	75	78	2	5	8	11	14	17	20	23	26
18	41	44	47	50	53	56	59	62	65	68	71	74	77
19	74	77	80	4	7	10	13	16	19	22	25	28	31
20	45	48	51	54	57	60	63	66	69	72	75	78	2
21	61	64	67	70	73	76	79	3	6	9	12	15	18
22	54	57	60	63	66	69	72	75	78	2	5	8	11
23	79	3	6	9	12	15	18	21	24	27	30	33	36
24	36	39	42	45	48	51	54	57	60	63	66	69	72
25	18	21	24	27	30	33	36	39	42	45	48	51	54
26	33	36	39	42	45	48	51	54	57	60	63	66	69
27	64	67	70	73	76	79	3	6	9	12	15	18	21
28	46	49	52	55	58	61	64	67	70	73	76	79	3
29	80	4	7	10	13	16	19	22	25	28	31	34	37
30	53	56	59	62	65	68	71	74	77	80	4	7	10
31	77	80	4	7	10	13	16	19	22	25	28	31	34
32	30	33	36	39	42	45	48	51	54	57	60	63	66
33	50	53	56	59	62	65	68	71	74	77	80	4	7
34	32	35	38	41	44	47	50	53	56	59	62	65	68
35	39	42	45	48	51	54	57	60	63	66	69	72	75
36	47	50	53	56	59	62	65	68	71	74	77	80	4
37	24	27	30	33	36	39	42	45	48	51	54	57	60
38	70	73	76	79	3	6	9	12	15	18	21	24	27
39	55	58	61	64	67	70	73	76	79	3	6	9	12

Table B.3—Hopping sequence set 3 (continued)

index	41	44	47	50	53	56	59	62	65	68	71	74	77
40	68	71	74	77	80	4	7	10	13	16	19	22	25
41	57	60	63	66	69	72	75	78	2	5	8	11	14
42	21	24	27	30	33	36	39	42	45	48	51	54	57
43	5	8	11	14	17	20	23	26	29	32	35	38	41
44	38	41	44	47	50	53	56	59	62	65	68	71	74
45	75	78	2	5	8	11	14	17	20	23	26	29	32
46	34	37	40	43	46	49	52	55	58	61	64	67	70
47	52	55	58	61	64	67	70	73	76	79	3	6	9
48	22	25	28	31	34	37	40	43	46	49	52	55	58
49	42	45	48	51	54	57	60	63	66	69	72	75	78
50	9	12	15	18	21	24	27	30	33	36	39	42	45
51	63	66	69	72	75	78	2	5	8	11	14	17	20
52	37	40	43	46	49	52	55	58	61	64	67	70	73
53	28	31	34	37	40	43	46	49	52	55	58	61	64
54	3	6	9	12	15	18	21	24	27	30	33	36	39
55	56	59	62	65	68	71	74	77	80	4	7	10	13
56	76	79	3	6	9	12	15	18	21	24	27	30	33
57	29	32	35	38	41	44	47	50	53	56	59	62	65
58	14	17	20	23	26	29	32	35	38	41	44	47	50
59	20	23	26	29	32	35	38	41	44	47	50	53	56
60	6	9	12	15	18	21	24	27	30	33	36	39	42
61	12	15	18	21	24	27	30	33	36	39	42	45	48
62	58	61	64	67	70	73	76	79	3	6	9	12	15
63	48	51	54	57	60	63	66	69	72	75	78	2	5
64	60	63	66	69	72	75	78	2	5	8	11	14	17
65	49	52	55	58	61	64	67	70	73	76	79	3	6
66	31	34	37	40	43	46	49	52	55	58	61	64	67
67	13	16	19	22	25	28	31	34	37	40	43	46	49
68	4	7	10	13	16	19	22	25	28	31	34	37	40
69	44	47	50	53	56	59	62	65	68	71	74	77	80
70	71	74	77	80	4	7	10	13	16	19	22	25	28
71	19	22	25	28	31	34	37	40	43	46	49	52	55
72	78	2	5	8	11	14	17	20	23	26	29	32	35
73	17	20	23	26	29	32	35	38	41	44	47	50	53
74	67	70	73	76	79	3	6	9	12	15	18	21	24
75	8	11	14	17	20	23	26	29	32	35	38	41	44
76	15	18	21	24	27	30	33	36	39	42	45	48	51
77	2	5	8	11	14	17	20	23	26	29	32	35	38
78	73	76	79	3	6	9	12	15	18	21	24	27	30
79	10	13	16	19	22	25	28	31	34	37	40	43	46

Annex C

(normative)

Formal description of MAC operation

This annex contains formal descriptions of the behavior of MAC station (STA) and access point (AP) entities. These descriptions also describe the frame formats and the generation and interpretation of information encoded in MAC frames, in the parameters of service primitives supported by the MAC, and in MIB attributes used or generated by the MAC. The MAC is described using the 1992 version of the ITU Specification and Description Language (SDL-92). SDL-92 is defined in ITU-T Recommendation Z.100 (03/93). An update to Z.100 was approved in 1996 (SDL-96), but none of the SDL facilities used in this annex were modified. An introduction to the MAC formal description is provided in Clause C.1. Definitions of the data types and operators used by the MAC state machines are provided in Clause C.2. An SDL system describing MAC operation at an IEEE 802.11 station is contained in Clause C.3. Finally, a subset of an SDL system describing the aspects of MAC operation at an IEEE 802.11 AP that differ from operation at a non-AP station is provided in Clause C.4.

In Annex D, the MAC and PHY management information bases are described in Abstract Syntax Notation One (ASN.1), defined in ISO/IEC 8824: 1990 and ISO/IEC 8825: 1990. ITU-T Recommendation Z.105 (03/95) defines the use of SDL in conjunction with ASN.1, allowing system behavior to be defined using SDL and data types to be defined using ASN.1. Incomplete tool support precluded the use of ITU-T Recommendation Z.105 in this annex. However, within the limits of ITU-T Recommendation Z.100 (referred to subsequently as Z.100), the data types in Clause C.2 are defined in a similar manner to ITU-T Recommendation Z.105 (referred to subsequently as Z.105). Annex E contains a listing of available documentation.

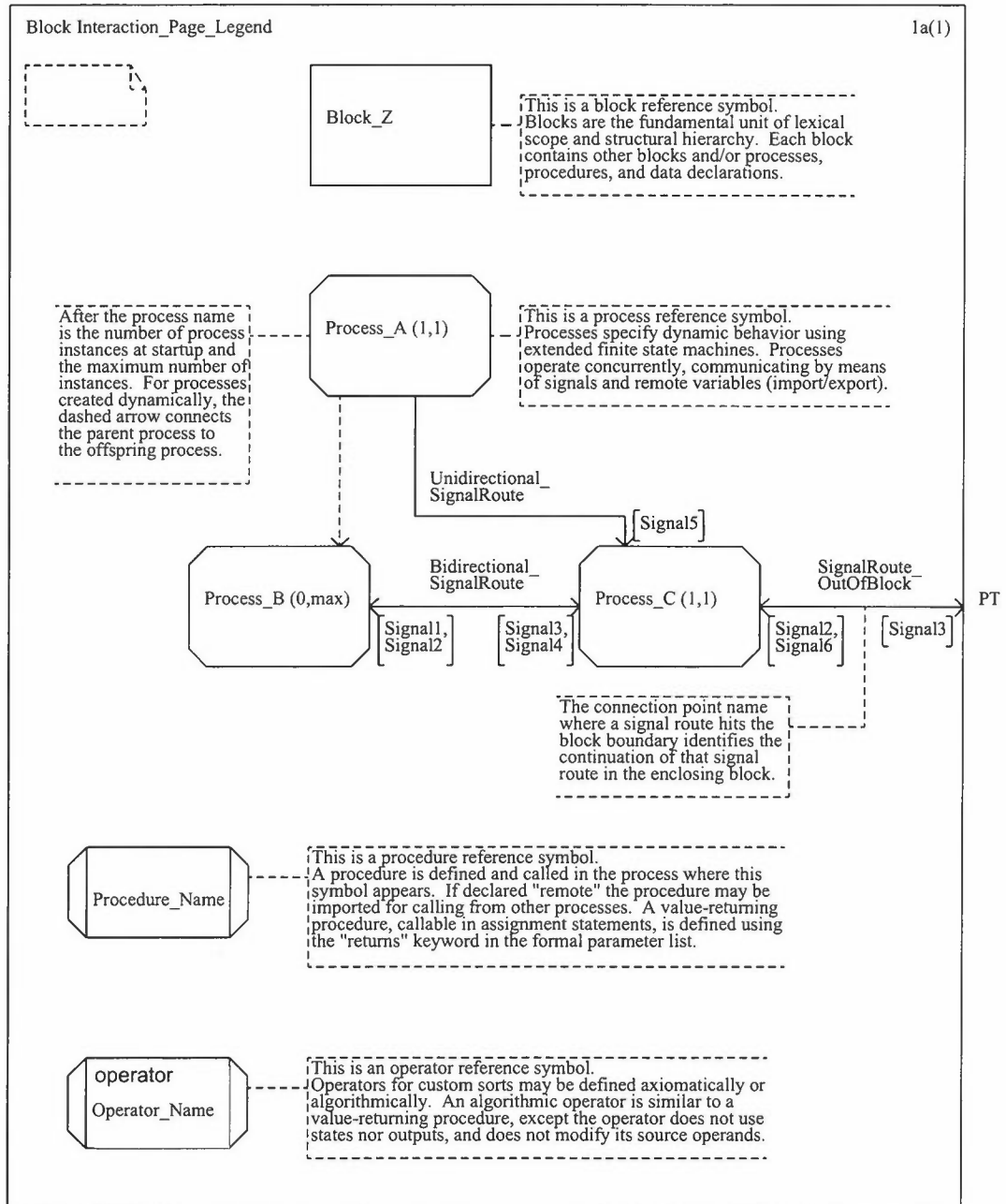
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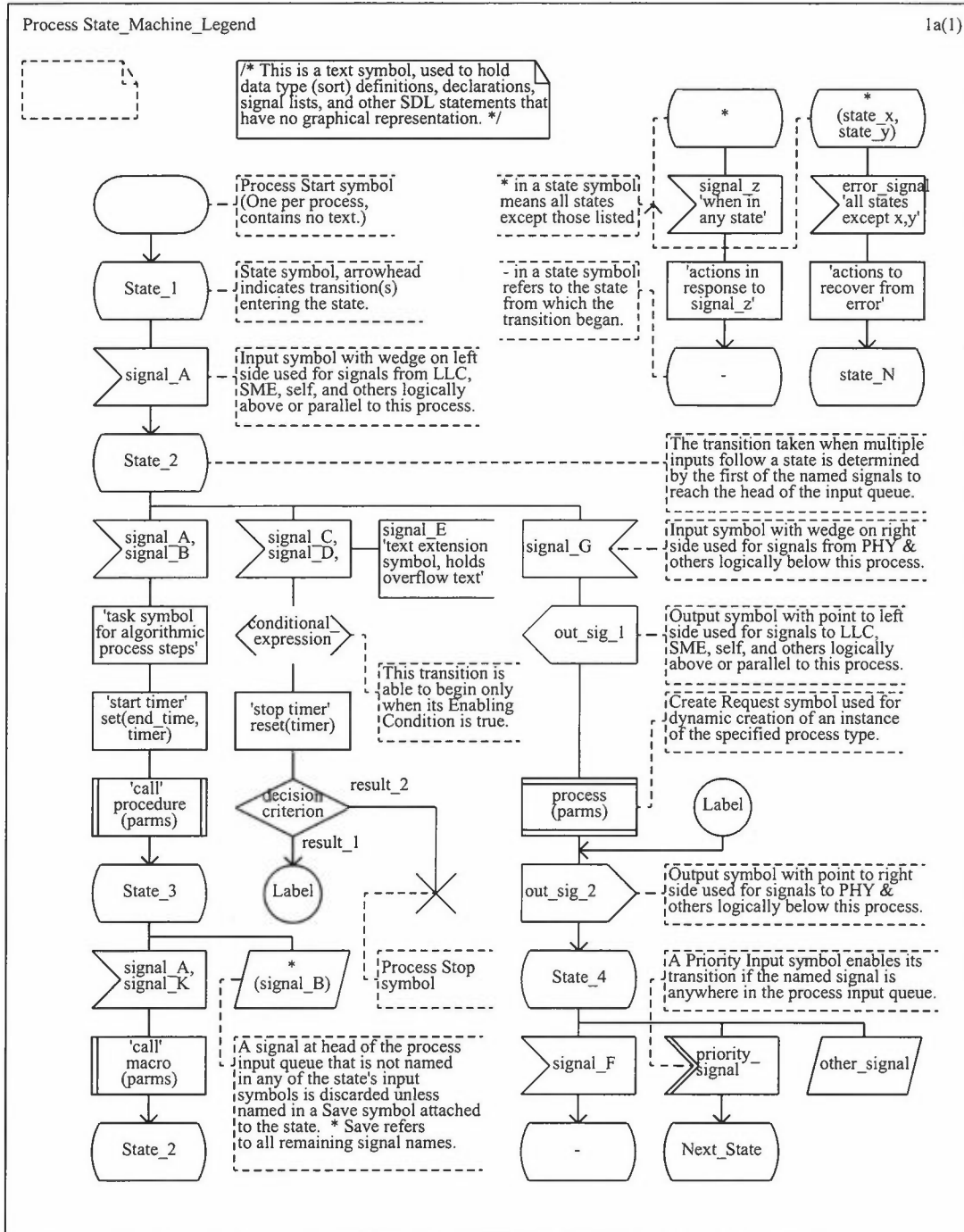
1—The SDL definitions in this annex should be usable with any SDL tool that supports the 1993 version or 1996 update of ITU-T Recommendation Z.100. Software for generating, analyzing, verifying, and simulating SDL system descriptions is available from several sources.

2—The SDL code in this annex was generated using *SDT/PC version 3.02*; from Telelogic AB, Malmo, Sweden (+46-40-174700; internet: telelogic.se); USA office in Princeton, NJ (+1-609-520-1935; internet: telelogic.com). Telelogic offers SDT for several workstation platforms in addition to SDT/PC.

3—The use of Telelogic's product to prepare this annex does not constitute an endorsement of SDT by the IEEE LAN MAN Standards Committee or by the IEEE.

4—The diagrams on the next two pages show most of the symbols of SDL graphical syntax (SDL-GR) used in the MAC formal description. The symbols in these diagrams have labels and comments that explain their meanings. These diagrams are intended to serve as a legend for the SDL-GR symbols that comprise most of the process interaction and state transition diagrams. These diagrams are neither a complete SDL system, nor a complete presentation of SDL-GR symbology. Also, this state machine fragment exists to illustrate the SDL graphical syntax, and does not describe any useful behavior.





C.1 Introduction to the MAC formal description

This formal description defines the behavior of IEEE 802.11 MAC entities. The MAC protocol functional decomposition used herein facilitates explicit description of the reference points and durations of the various timed intervals; the bases for generation and/or validation of header fields, service parameters, and MIB attributes; and the interpretation of each value in cases where enumerated data types are used in service parameters.

C.1.1 Fundamental assumptions

The MAC protocol is described as an SDL system, which is a set of extended finite state machines. Each state machine is a set of independent processes, all of which operate concurrently. All variable data-holding entities and procedures exist solely within the context of a single process. In SDL all interprocess communication is done with signals (there are no global variables). Signals may be sent and received explicitly, using SDL's output and input symbols, or implicitly, using SDL's export/import mechanism (only if the variables or procedures are declared "remote"). By default, signals incur delays when traversing channels between blocks; however, only nondelaying channels and signal routes are used in the MAC state machines, and all remote variables and procedures are declared with the "nodelay" property.

State transitions, procedure calls, and tasks (assignment statements and other algorithmic processing steps) are assumed to require zero time. This permits the time intervals that are part of the normative MAC behavior to be defined explicitly, using SDL timers. One unit of system time (a 1.0 change in the value of "now") is assumed to represent one microsecond of real time. Usec (microsecond) and TU (time unit) data types are defined, with operators to convert Usec and TU values to SDL time or duration when necessary.

The SDL system boundary encloses the MAC entities. The LLC, SME, PHY, and distribution system are part of the environment. SDL generally assumes that entities in the environment operate as specified; however, the MAC state machines that communicate with the various SAPs attempt to validate inputs from the environment, and to handle cases where a pair of communicating entities, one within the system and the other outside the system boundary, have different local views of the medium, station, or service state. All stations in an IEEE 802.11 service set are assumed to exhibit the behaviors described herein. Nevertheless, because of the open nature of the wireless medium, the MAC state machines check for error cases that can arise only when an entity on the wireless medium is transmitting IEEE 802.11 PDUs, but is not obeying the communication protocols specified by this standard.

C.1.2 Notation conventions

When practical, names used in the clauses of this standard are spelled identically in this annex. The principal exceptions are those names that conflict with one of SDL's reserved words (such as power management mode "active," which is renamed "sta_active" in SDL). To help fit the SDL text into the graphic symbols, acronyms with multiple, sequential capital letters are written with only the first letter capitalized (e.g., "MSDU" is written "Msdu" and "MLMEJoin.request" is written "MlmeJoin.request").

SDL reserved words and the names of variables and synonyms (named constants) begin with lowercase letters. The names of sorts (data types), signals, signal routes, channels, blocks, and processes begin with uppercase letters. The names of certain groups of variables and/or synonyms begin with a particular lowercase letter, followed by the remainder of the name, beginning with an uppercase letter. These groups are

"aNameOfAttribute"	PHY operational parameters.
"cNameOfCapability"	Capability bits, also used for internal values exported as MIB counters.
"dNameOfDuration"	Duration (relative time) values, declared as Usec, TU, or Duration.
"dot11NameOfAttribute"	MIB attributes.

“eNameOfElement”	Element ID values.
“mNameOfVariable”	Remote variables used for intra-MAC communication, but not part of the MIB. Most of these variables are exported from the MLME block.
“sNameOfStaticValue”	Synonyms for static data values used within the MAC.
“tNameOfTime”	Time (absolute time) values, declared as Usec, TU, or Time. The names of timers begin with “T.”

C.1.3 Modeling techniques

State machines are grouped according to defined function sets that are visible, directly or indirectly, at an exposed interface. The emphasis in the organization of the state machines is explicitly to show initiation of and response to events at the exposed interfaces, and time-related actions, including those dependent on the absence of external events (e.g., response timeouts) and intervals measured in derived units (e.g., backoff “time” in units of slots during which the wireless medium is idle). The operations associated with the various state transitions emphasize communication functions. Most of the details regarding insertion, extraction, and encoding of information in fields of the PDUs is encapsulated with the definitions of those fields. This approach, which relies heavily on SDL’s abstract data type and inheritance mechanisms, permits the behavior of the data-holding entities to be precisely defined, without obscuring process flow by adding in-line complexity to the individual state transitions.

The modeling of PDUs and SDUs requires sorts such as octet strings, and operators such as bitwise boolean functions, which are not predefined in SDL. These sorts and operators are defined in Package macsorts, which appears in Clause C.2.

Protocol and service data unit sorts are based on the **Bit** sort. Bit is a subtype of SDL’s predefined Boolean sort. As a result, Bit literals “0” and “1” are alternative names for “false” and “true,” and have no numeric significance. To use “0” or “1” as integer values requires a conversion operation. Items of the **Bitstring** sort are 0-origin, variable-length strings of Bits. With Bitstring operands, operators “and,” “or,” “xor,” and “not” operate bitwise, with the length of the result equal to the length of the longest (or only) source string. The **Octet** sort is a subtype of Bitstring that adds conversion operators to and from Integer. Each item of the Octet sort has length=8 {by usage convention in Z.100, enforced in Z.105}. Items of the **Octetstring** sort are 0-origin, variable-length strings of Octets. The **Frame** sort is a subtype of Octetstring that adds operators to extract and to modify all MAC header fields and most other MAC frame fields and elements. Most MAC fields and elements that contain named values with specific value assignments or enumerations are defined as subtypes of Frame, Octetstring, or Bitstring with the names added as literals or synonyms, so that the state machines can refer to the names without introducing ambiguity about the value encodings.

Where communication at a SAP or between processes is strictly first in first out (FIFO), the (implicit) input queue of the SDL processes is used. When more sophisticated queue management is needed, a queue whose entries are instances of one, specified sort is created using the **Queue** generator. Entries on Queue sorts may be added and removed at either the tail or the head, and the number of queue entries may be determined. The contents of a Queue may also be searched to locate entries with particular parameter values.

Clause C.2 contains an SDL-92 Package (a named collection of SDL definitions that can be included by reference into an SDL System specification), which is a formal description of the formats and data encodings used in IEEE 802.11 SDUs, PDUs, and the parameters of the service primitives used at each of the SAPs supported by the IEEE 802.11 MAC. This package also contains definitions for some data structures and operators used internally by one or more of the MAC state machines.

The behaviors of many intra-MAC operators are part of the normative description of the MAC protocol because results of the specified operations are visible, directly or indirectly, at exposed interfaces. For example, custom operators are used to define the generation of the CRC-32 value used in the FCS field (operator crc32, page 301), the calculation of frame transmission time used as part of the value in the Duration/ID field

in certain types of frames (operator `calcDur`, page 316), the comparison of the values of particular fields of a received MAC header with cached data values as part of the procedure for detecting duplicate frames (operator `searchTupleCache`, page 289), and numerous other aspects of frame formats and information encoding. On the other hand, data structures used solely for intra-MAC storage or for transferring of information between different state machines of a single station or access point, are only normative to the extent that they define items of internal state and the temporal sequence necessary for proper operation of the MAC protocol. The specific structures and encodings used for internal data storage and communication functions in this formal description do *not* constrain MAC implementations, provided those implementations exhibit the specified behaviors at the defined SAPs and, in conjunction with an appropriate PHY, on the wireless medium.

C.2 Data type and operator definitions for the MAC state machines

This clause is in SDL/PR (phrase notation), with the exception of procedural operators, which are defined in SDL/GR (graphic notation). Package `macsorts` contains the definitions of the sorts (data types with associated operators and literals) and synonyms (named constants) used by the MAC state machines. Package `macmib` defines data types for attributes in the MAC MIB, and portions of the PHY MIB, accessed by the MAC state machines. Package `macmib` exists solely to satisfy SDL's strong type checking in the absence of an SDL tool that fully supports Z.105 (the combined use of SDL with ASN.1).



Package macsorts

3101_d\MacEnum(31)

```

/* PACKAGE MACSORTS */
/* This package contains definitions of the custom sorts (data types), operators,
literals, and synonyms (named constants) used by the MAC state machines. */

```

```

/*****
 * Enumerated types used within the MAC state machines
 *****/
newtype ChangeType /* type of change due at the next boundary */
literals dwell, /* dwell (only with FH PHY) */
mocc; /* medium occupancy (only with PCF) */
endnewtype ChangeType;
newtype lmed /* priority for queuing MMPDUs, relative to MSDUs */
literals head, /* place MMPDU at head of transmit queue */
norm; /* place MMPDU at tail of transmit queue */
endnewtype lmed;
newtype NavSrc /* source of duration in SetNav & ClearNav signals */
literals rts, /* RTS frame */
cfpBss, cfpBss, /* start/end of CFP in own BSS */
cfpOther, cfpOther, /* start/end of CFP in other BSS */
cswitch, /* channel switch */
misc, /* durld from other frame types */
nosrc; /* non-reception events */
endnewtype NavSrc;
newtype PsMode /* power save mode of a station (PsResponse signal) */
literals sta_active, power_save, unknown; endnewtype PsMode;
newtype PsState /* power save state of this station */
literals awake, doze; endnewtype PsState;
newtype StateErr /* requests disassoc or deauth (MmIndicate signal) */
literals noerr, class2, class3; endnewtype StateErr;
newtype StationState /* asoc/auth state of sta (SsResponse signal) */
literals not_auth, auth_open, auth_key, asoc, dis_asoc;
endnewtype StationState;
newtype TxResult /* transmission attempt status (PduConfirm signal) */
literals successful, partial, retryLimit, txLifetime,
atimAck, atimNak; endnewtype TxResult;

```

```

/*****
 * Enumerated types used in PHY service primitives
 *****/
newtype CcaStatus /* <state> parameter of PhyCca.indication */
literals busy, idle; endnewtype CcaStatus;
newtype PhyRxStat /* <rxerror> parameter of PhyRxEnd.indication */
literals no_error, fmt_violation, carrier_lost, unsupt_rate;
endnewtype PhyRxStat;

```

```

/*****
 * Placeholders for Mlme/Plme Get/Set Parameter Values
 *****/
/* MibAtrib (placeholder in MlmeGet/Set definitions) */
syntype MibAtrib = Charstring endsyntype MibAtrib;
/* MibValue (placeholder in MlmeGet/Set definitions) */
syntype MibValue = Integer endsyntype MibValue;

```



Package macsorts

3102_d\LmeEnum(31)



```

/*****
 * Enumerated types used in Mac and Mlme service primitives
 *****/
newtype AuthType /* <authentication type> parm in Mlme primitives */
inherits Octetstring operators all;
adding literals open_system, shared_key;
axioms open_system == mkOS(0, 2); shared_key == mkOS(1, 2);
endnewtype AuthType;
newtype AuthTypeSet powerset( AuthType); endnewtype AuthTypeSet;
newtype BssType /* <BSS type> parameter & BSS description element */
literals infrastructure, independent, any_bss; endnewtype BssType;
newtype BssTypeSet powerset( BssType); endnewtype BssTypeSet;
newtype CfPriority /* <priority> parameter of various requests */
literals contention, contentionFree; endnewtype CfPriority;
newtype MibStatus /* <status> parm of Mlme/Plme Get/Set.confirm */
literals success, invalid, write_only, read_only;
endnewtype MibStatus;
newtype MlmeStatus /* <status> parm of Mlme operation confirm */
literals success, invalid, timeout, refused,
to_many_req, already_bss; endnewtype MlmeStatus;
newtype PwrSave /* <power save mode> parameter of MlmePowerMgt */
literals sta_active, power_save; endnewtype PwrSave;
newtype Routing /* <routing info> parameter for MAC data service */
literals null_rt; endnewtype Routing;
newtype RxStatus /* <reception status> parm of MaUnitdata indication */
literals rx_success, rx_failure; endnewtype RxStatus;
newtype ScanType /* <scan type> parameter of MlmeScan.request */
literals active_scan, passive_scan; endnewtype ScanType;
newtype ServiceClass /* <service class> parameter for MaUnitdata */
literals reorderable, strictlyOrdered; endnewtype ServiceClass;
newtype TxStatus /* <transmission status> parm of MaUnitdataStatus */
literals successful, retryLimit, txLifetime, noBss,
excessiveDataLength, nonNullSourceRouting,
unsupportedPriority, unavailablePriority,
unsupportedServiceClass, unavailableServiceClass,
unavailableKeyMapping; endnewtype TxStatus;

```



Package macsorts

3103_e\IntraMac(31)



```

/*****
 *   Intra-MAC remote variables (names of form mXYZ)
 *****/
remote mActingAsAp Boolean nodelay; /* =true if STA started BSS */
remote mAid AsocId nodelay; /* AID assigned to STA by AP */
remote mAssoc Boolean nodelay; /* =true if STA associated w/BSS */
remote mAtimW Boolean nodelay; /* =true if ATIM window in prog */
remote mBkIP Boolean nodelay; /* =true if backoff in prog */
remote mBrates Ratestring nodelay; /* basic rate set for this sta */
remote mBssid MacAddr nodelay; /* identifier of current (!)BSS */
remote mCap Octetstring nodelay; /* capability info from MlmeJoin */
remote mCfp Boolean nodelay; /* =true if CF period in progress */
remote mDisable Boolean nodelay; /* =true if not in any BSS; then */
/* TX only sends probe_req; RX only accepts beacon, probe_rsp */
remote mDtimCount Integer nodelay; /* =0 at Tbt of Beacon with DTIM */
remote mFxp Boolean nodelay; /* =true during frame exchange seq */
remote mbss Boolean nodelay; /* =true if STA is member of IBSS */
remote mListenInt Integer nodelay; /* beacons between wake up @TBTT */
remote mNavEnd Time nodelay; /* NAV end Time, <=now when idle */
remote mNextBdry Time nodelay; /* next boundary Time; =0 if none */
remote mNextTbtt Time nodelay; /* Time next beacon due to occur */
remote mPcAvail Boolean nodelay; /* =true if point coord in BSS */
remote mPcDlvr Boolean nodelay; /* =true if CF delivery only */
remote mPcPoll Boolean nodelay; /* =true if CF delivery & polling */
remote mPdly Usec nodelay; /* probe delay from start or join */
remote mPss PsState nodelay; /* power save state of STA */
remote mReceiveDTIMs Boolean nodelay; /* =true if DTIMs received */
remote mRxA Boolean nodelay; /* =true if RX indicated by PHY */
remote mSsld Octetstring nodelay; /* name of the current (!)BSS */
remote procedure TSF nodelay; /* read & update 64-bit TSF timer */
fpar Integer, Boolean; returns Integer;

```



Package macsorts

3104_d\StaticData(31)



```

/*****
 *   Named static data values (names of form sXYZ)
 *****/
synonym sMaxMsduLng Integer = 2304; /* max octets in an MSDU */
synonym sMacHdrLng Integer = 24; /* octets in data header, no WEP */
synonym sWepHdrLng Integer = 28; /* octets in data header with WEP */
synonym sWepAddLng Integer = 8; /* octets added for WEP */
synonym sWdsAddLng Integer = 6; /* octets added for WDS (addr4) */
synonym sCrcLng Integer = 4; /* octets for crc32 (FCS, ICV) */
synonym sMaxMpduLng Integer = /* max octets in an MPDU */
(sMaxMsduLng + sMacHdrLng + sWdsAddLng + sWepAddLng + sCrcLng);
syntype FrameIndexRange = Integer /* index range for octets in MPDU */
constants 0 : sMaxMpduLng endsyntype FrameIndexRange;
synonym sTsOctet Integer = 24; /* first octet of Timestamp field */
synonym sMinFragLng Integer = 256; /* min value for aMpduMaxLength */
synonym sMaxFragNum Integer = /* maximum fragment number */
(sMaxMsduLng / (sMinFragLng - sMacHdrLng - sCrcLng));
synonym sAckCtsLng Integer = 112; /* bits in ACK and CTS frames */
    
```

```

/*****
 *   Station configuration flags (static, supplementary to MIB)
 *****/
synonym sVersion Integer = 0; /* supported Protocol Version */
synonym sCanBeAp Boolean = false; /* =true if STA can operate as AP */
synonym sCanBePc Boolean = false; /* =true if AP can be Point Coord */
synonym sCfPollable Boolean = true; /* =true if responds to CF-polls */
    
```



Package macsorts

3105_dUsec_TU(31)

```

*****
*   Discrete microsecond and Time Unit sorts
*****
/* SDL does not define the relationship between its concept */
/* of Time and physical time in the system being described. */
/* An abstraction is needed to establish this relationship, */
/* because Time in SDL uses the semantics of Real, whereas */
/* time in the MAC protocol is discrete, with the semantics */
/* of Natural and a step size (resolution) of 1 microsecond. */
/* Most MAC times are defined using the subtypes of Integer */
/* Usec and TU. These have operators for explicit conversion */
/* to SDL Time (tUsec, tTU), SDL Duration (dUsec, dTU), and */
/* from SDL Time (uTime, tuTime) as needed to comply with SDL's */
/* strong type checking. Where the MAC state machines need to */
/* access the contents of the TSF timer, SDL's 'now' (current */
/* time) is used. This yields readable time-dependent code, */
/* but the value of 'now' cannot be modified by an SDL program, */
/* so adopting the TSF time from timestamps in received Beacons */
/* or Probe Responses is shown as an informal task symbol. */
/* Microsecond sort -- also has operators tmin and tmax */
newtype Usec inherits Integer operators all;
adding operators
dUsec : Usec -> Duration;
tUsec : Usec -> Time;
uTime : Time -> Usec;
tmax  : Usec, Usec -> Usec;
tmin  : Usec, Usec -> Usec;
axioms for all u, w in Usec(
  u >= w ==> tmax(u, w) == u;    u < w ==> tmax(u, w) == w;
  u >= w ==> tmin(u, w) == w;    u < w ==> tmin(u, w) == u;
  for all t in Time( for all r in Real(
    r = float(u) ==> tUsec(u) == Time!(Duration!(r));
    t = Time!(Duration!(r)) and u = fix(r) ==> u == uTime(t);));
  for all d in Duration( for all r in Real(
    r = float(u) ==> dUsec(u) == Duration!(r); ));
  constants >= 0 /* constrain value range to be non-negative */
endnewtype Usec;
/* Time Unit sort -- (1 * TU) = (1024 * Usec) */
newtype TU inherits Integer operators all;
adding operators
dTU   : TU -> Duration;
tTU   : TU -> Time;
tuTime : Time -> TU;
u2TU  : Usec -> TU;
tu2U  : TU -> Usec;
axioms for all k in TU( for all t in Time( for all r in Real(
  r = float(k) ==> tTU(k) == Time!(Duration!(1024 * r));
  t = Time!(Duration!(r)) and k = (fix(r) / 1024) ==> k == tuTime(t);));
  for all d in Duration( for all r in Real(
    r = float(k) ==> dTU(k) == Duration!(1024 * r);));
  for all u in Usec( u2TU(u) == u / 1024; tu2U(k) == k * 1024; ));
  constants >= 0 /* constrain value range to be non-negative */
endnewtype TU;

```



Package macsorts
3106_dString0(31)

```

/*****
 * Generator for 0-origin String sorts (adapted from Z.105, Annex A)
 *****/
/* String0(sort, nullSymbol) can define strings of any sort. */
/* These strings are indexed starting from 0 rather than 1. */
/* Sorts defined by String0 have the normal String operators, plus */
/* Tail (all but first item), Head (all but last item), and */
/* aggregators S2, S3, S4, S6, S8 (make fixed length strings). */
generator String0(type Item, literal Emptystring)
  literals Emptystring;
  operators
    MkString : Item -> String0; /* make a string from an item */
    Length : String0 -> Integer; /* length of string */
    First : String0 -> Item; /* first item in string */
    Tail : String0 -> String0; /* all but first item in string */
    Last : String0 -> Item; /* last item in string */
    head : String0 -> String0; /* all but last item in string */
    "/" : String0, String0 -> String0; /* concatenation */
    Extract! : String0, Integer -> Item; /* get item from string */
    Modify! : String0, Integer, Item -> String0; /* modify string */
    SubStr : String0, Integer, Integer -> String0;
    /* SubStr(s,i,j) is string0 of length j starting at string0(i) */
    S2 : Item, Item -> String0; S3 : Item, Item, Item -> String0;
    S4 : Item, Item, Item, Item -> String0;
    S6 : Item, Item, Item, Item, Item, Item -> String0;
    S8 : Item, Item, Item, Item, Item, Item, Item, Item -> String0;
  /* axioms continued on next page... */

endgenerator String0;

```



Package macsorts

3107_aString0(31)



```

/* String0 axioms */
/* for all item0,item1,item2,item3,item4,item5,item6,item7 in Item(
for all s, s1, S2, S3 in String0( for all i, j in Integer(
constructors are Emptystring, MkString, and "///";
equalities between constructor terms
s // Emptystring == s; Emptystring // s == s;
(s1 // S2) // S3 == s1 // (S2 // S3);
definition of Length by applying it to all constructors
type String Length(Emptystring) == 0;
type String Length(MkString(item0)) == 1;
type String Length(s1 // S2) == Length(s1) + Length(S2);
definition of Extract! by applying it to all constructors,
Extract!(MkString(item0), 0) == item0;
i < Length(s1) ==> Extract!(s1 // S2, i) == Extract!(s1, i);
i >= Length(s1) ==> Extract!(s1 // S2, i) == Extract!(S2, i - Length(s1));
i < 0 or i >= Length(s) ==> Extract!(s, i) == error!;
definition of First and Last by other operations
First(s) == Extract!(s, 0);
Last(s) == Extract!(s, Length(s) - 1);
definition of substr(s,i,j) by induction on j,
i >= 0 and i <= Length(s) ==> SubStr(s, i, 0) == Emptystring;
i >= 0 and j > 0 and i + j <= Length(s) ==> SubStr(s, i, j) ==
SubStr(s, i, j - 1) // MkString(Extract!(s, i + j - 1));
i < 0 or j < 0 or i + j > Length(s) ==> SubStr(s, i, j) == error!;
definition of Modify!, Head, Tail, Sx by other operations
Modify!(s, i, item0) == SubStr(s, 0, i) // MkString(item0) //
SubStr(s, i + 1, Length(s) - i - 1);
head(s) == SubStr(s, 0, Length(s) - 1);
Tail(s) == SubStr(s, 1, Length(s) - 1);
S2(item0, item1) == MkString(item0) // MkString(item1);
S3(item0, item1, item2) ==
MkString(item0) // MkString(item1) // MkString(item2);
S4(item0, item1, item2, item3) ==
MkString(item0) // MkString(item1) // MkString(item2) //
MkString(item3);
S6(item0, item1, item2, item3, item4, item5) ==
MkString(item0) // MkString(item1) // MkString(item2) //
MkString(item3) // MkString(item4) // MkString(item5);
S8(item0, item1, item2, item3, item4, item5, item6, item7) ==
MkString(item0) // MkString(item1) // MkString(item2) //
MkString(item3) // MkString(item4) // MkString(item5) //
MkString(item6) // MkString(item7); )))
*/

```




Package macsorts

3108_d1Bitstring(31)

```

*****
*   ASN.1-style BIT sort (from Z.105, Annex A)
*****
/* Bit is a subtype of Boolean -- bit values 0 and 1 are
/* not numerals and cannot be used with Integer operators */
newtype Bit inherits Boolean
  literals 0 = false, 1 = true; operators all; endnewtype Bit;

```

```

*****
*   ASN.1-style BIT STRING sort (adapted from Z.105, Annex A)
*****
/* Bitstrings are 0-origin strings of Bit. Z.105 uses ASN.1-style */
/* literals in binary ('1011'B) or hexadecimal ('D3'H), but this */
/* syntax is not accepted for Z.100 string literals. Therefore, */
/* this version provides only hexadecimal literals 0x00-0xFF. */
/* Bitstring operators '=>', 'not', 'and', 'or', and 'xor' act */
/* bitwise, with the length of the result string equal to the */
/* length of the longest (or only) source string. */
newtype Bitstring String0(Bit, "")
  adding literals macro Hex_Literals;
  operators
    "not" : Bitstring -> Bitstring;
    "and" : Bitstring, Bitstring -> Bitstring;
    "or"  : Bitstring, Bitstring -> Bitstring;
    "xor" : Bitstring, Bitstring -> Bitstring;
    "=>" : Bitstring, Bitstring -> Bitstring;  noequality;
  axioms macro Hex_Axioms;
  for all s, s1, S2, S3 in Bitstring(
    s = s == true;    s1 = S2 == S2 = s1;
    s1 /= S2 == not (s1 = S2);    s1 = S2 == true ==> s1 == S2;
    ((s1 = S2) and (S2 = S3)) ==> s1 = S3 == true;
    ((s1 = S2) and (S2 /= S3)) ==> s1 = S3 == false;
    for all b, b1, b2 in Bit(
      not ("") == "";
      not (MkString(b) // s) == MkString(not (b)) // not (s);
      " and " == "";
      Length(s) > 0 ==> " and s == MkString(0) and s;
      Length(s) > 0 ==> s and " == s and MkString(0);
      (MkString(b1) // s1) and (MkString(b2) // S2) ==
        MkString(b1 and b2) // (s1 and S2);
      s1 or S2 == not (not s1 and not S2);
      s1 xor S2 == (s1 or S2) and not (s1 and S2);
      s1 => S2 == not (not s1 and S2););
  map for all b1, b2 in Bitstring literals(
    for all bs1, bs2 in Charstring literals(
/* connection to the String generator */
      for all b in Bit literals(
        spelling(b1) = "" // bs1 // bs2 // "",
        spelling(b2) = "" // bs2 // "", spelling(b) = bs1
        ==> b1 == MkString(b) // b2; ));
endnewtype Bitstring;

```



Package macsorts

3109_d\Octetstring(31)

```

/*****
 *   OCTET sort (influenced by Z.105, Annex A)
 *****/
/* Octet is a subtype of Bitstring where length always =8. */
/* Z.105 adds a "size" keyword to SDL and defines Octet with */
/* "... constants size (8) ..." to impose this length constraint. */
/* Here Octet relies on proper use maintain lengths as multiples */
/* of 8. Proper length strings are created by the hexadecimal */
/* Bitstring literals (e.g. 0xD5) and operator mkOctet: */
/* o:= mkOctet(i) converts a non-negative Integer (mod 256) */
/* to an Octet (exactly 8 bits) */
/* i:= octetVal(o) converts an Octet to an Integer (0:255) */
/* o:= flip(o) reverses bit order of the Octet */
/* (0<-->7, 1<-->6, 2<-->5, 3<-->4) */
newtype Octet inherits Bitstring operators all;
adding operators
mkOctet : Integer -> Octet;
octetVal : Octet -> Integer;
flip : Octet -> Octet;
axioms
for all i in Integer( for all z in Octet(
i = 0 ==> mkOctet(i) == S8(0, 0, 0, 0, 0, 0, 0, 0);
i = 1 ==> mkOctet(i) == S8(1, 0, 0, 0, 0, 0, 0, 0);
i > 1 and i <= 255 ==> mkOctet(i) ==
SubStr((First(mkOctet(i mod 2)) // mkOctet(i / 2)), 0, 8);
i > 255 ==> mkOctet(i) == mkOctet(i mod 256);
i < 0 ==> mkOctet(i) == error!;
z = MkString(0) ==> octetVal(z) == 0;
z = MkString(1) ==> octetVal(z) == 1;
Length(z) > 1 and Length(z) <= 8 ==>
octetVal(z) == octetVal(First(z)) +
(2 * (octetVal(SubStr(z, 1, Length(z) - 1))));
Length(z) > 8 ==> octetVal(z) == error!;
flip(z) == S8(z(7),z(6),z(5),z(4),z(3),z(2),z(1),z(0)); ));
endnewtype Octet;

```



Package macsorts

3109.1_a)Octetstring(31)



```

*****
*   OCTET STRING sort (somewhat influenced by Z.105, Annex A)
*****
/* Octetstrings are 0-ORIGIN strings of Octet, NOT 1-ORIGIN */
/* strings like Octet_String in Z.105 (hence the name change). */
/* Octetstring has conversion operators to and from Bitstring, */
/* and integer to Octetstring. Octetstring literals are "null" */
/* and 1-4, 6, 8 item 0x00 strings O1, O2, O3, O4, O6, O8. */
newtype Octetstring String0(Octet, null)
adding literals O1, O2, O3, O4, O6, O8;
operators
  B_S : Octetstring -> Bitstring; /* name changed from Z.105 */
  O_S : Bitstring -> Octetstring; /* name changed from Z.105 */
  mkOS : Integer,Integer -> Octetstring; /* mkOS(i1,i2) returns */
      /* mkstring(mkOctet(i1)) padded (0x00) to length i2 */
  mk2octets : Integer -> Octetstring; /* 16-bit int to 2-octets */
axioms
for all b, b1, b2 in Bitstring(
  for all s in Octetstring( for all o in Octet(
    B_S(null) == null; O_S(null) == null;
    B_S(MkString(o) // s) == o // B_S(s);
    Length(b1) > 0, Length(b1) < 8 ==>
      O_S(b1) == MkString(b1 or 0x00); /* expand b1 to 8 bits */
    b == b1 // b2, Length(b1) = 8 ==>
      O_S(b) == MkString(b1) // O_S(b2);
    for all i, k in Integer(
      k = 1 ==> mkOS(i, k) == MkString(mkOctet(i));
      k > 1 ==> mkOS(i, k) == mkOS(i, k - 1) // MkString(0x00);
      k <= 0 ==> error!;
      mk2octets(i) == MkString(mkOctet(i mod 256)) //
        MkString(mkOctet(i / 256)); );
    O1 == MkString(0x00); O2 == O1 // O1;
    O3 == O2 // O1; O4 == O2 // O2;
    O6 == O4 // O2; O8 == O4 // O4; ));
map for all O1, O2 in Octetstring literals(
  for all b1, b2 in Bitstring literals(
    spelling(O1) = spelling(b1), spelling(O2) = spelling(b2)
    ==> O1 = O2 == b1 = b2; ));
endnewtype Octetstring;

```



Package macsorts

3110_dMacAddr(31)

```

*****
*   MAC Address sorts
*****/
/* MacAddr is a subtype of Octetstring with added operators: */
/* isGroup(m) =true if given a group address */
/* isBcst(m) =true if given the broadcast address */
/* isLocal(m) =true if given a locally-administered address */
/* adrOs(m) converts MacAddr to Octetstring */
/* MAC addresses must be defined to be exactly 6 octets long, */
/* typically using the S6 operator or nullAddr synonym. */
newtype MacAddr inherits Octetstring operators all;
adding operators
  isGroup : MacAddr -> Boolean;
  isBcst  : MacAddr -> Boolean;
  isLocal : MacAddr -> Boolean;
  adrOs   : MacAddr -> Octetstring;
axioms
  for all m in MacAddr(
    (Length(m) = 6) and ((Extract!(m,0) and 0x01) = 0x01) ==> isGroup(m) == true;
    (Length(m) = 6) and ((Extract!(m,0) and 0x01) = 0x00) ==> isGroup(m) == false;
    (Length(m) = 6) and (m = S6(0xFF,0xFF,0xFF,0xFF,0xFF,0xFF)) ==> isBcst == true;
    (Length(m) = 6) and (m /= S6(0xFF,0xFF,0xFF,0xFF,0xFF,0xFF)) ==> isBcst == false;
    (Length(m) = 6) and ((Extract!(m,0) and 0x02) = 0x02) ==> isLocal == true;
    (Length(m) = 6) and ((Extract!(m,0) and 0x02) = 0x00) ==> isLocal == false;
    Length(m) /= 6 ==> error! /* common error! term */;
    for all o in Octetstring(m = MacAddr!(o) == adrOs(m) = o; ));
endnewtype MacAddr;
newtype MacAddrSet powerset( MacAddr) endnewtype MacAddrSet;
synonym bcstAddr MacAddr = /* Broadcast Address */
  <<type MacAddr>> S6(0xFF,0xFF,0xFF,0xFF,0xFF,0xFF);
synonym nullAddr MacAddr = /* Null Address */
  << type MacAddr>> S6(0x00,0x00,0x00,0x00,0x00,0x00);

```

```

*****
*   BSS description sorts
*****/
/* BssDscr is used with MlmeScan.confirm and MlmeJoin.request */
newtype BssDscr struct
  bdBssId MacAddr;
  bdSsId Octetstring; /* 1 <= length <= 32 */
  bdType BssType;
  bdBcnPer TU; /* beacon period in Time Units */
  bdDtimPer Integer; /* DTIM period in beacon periods */
  bdTstamp Octetstring; /* 8 Octets from ProbeRsp/Beacon */
  bdStartTs Octetstring; /* 8 Octets TSF when rx Tstamp */
  bdPhyParms PhyParms; /* empty if not needed by PHY */
  bdCfParms CfParms; /* empty if not CfPollable/no PCF */
  bdIbssParms IbssParms; /* empty if infrastructure BSS */
  bdCap Capability; /* capability information */
  bdBrates Ratestring; /* BSS basic rate set */
endnewtype BssDscr;
newtype BssDscrSet powerset( BssDscr) endnewtype BssDscrSet;

```



Package macsorts
3111_d\TupleCache(31)

```

*****
* Duplicate filtering support sorts
*****/
syntype FragNum = Integer /* Range of possible fragment numbers */
constants 0:sMaxFragNum endsyntype FragNum;
syntype SeqNum = Integer /* Range of possible sequence numbers */
constants 0:4095 endsyntype SeqNum;
newtype Tuple struct /* for duplicate filtering & defragmentation */
full Boolean; /* =true if Tuple contains valid info */
ta MacAddr; /* transmitting station address (Addr2) */
sn SeqNum; /* Msdu/Mmpdu sequence number */
fn FragNum; /* most recent Mpdu fragment number */
tRx Time; /* reception time (endRx of fragment) */
default (. false, nullAddr, 0, 0, 0.);
endnewtype Tuple;

```

operator

clearTupleCache

operator

searchTupleCache

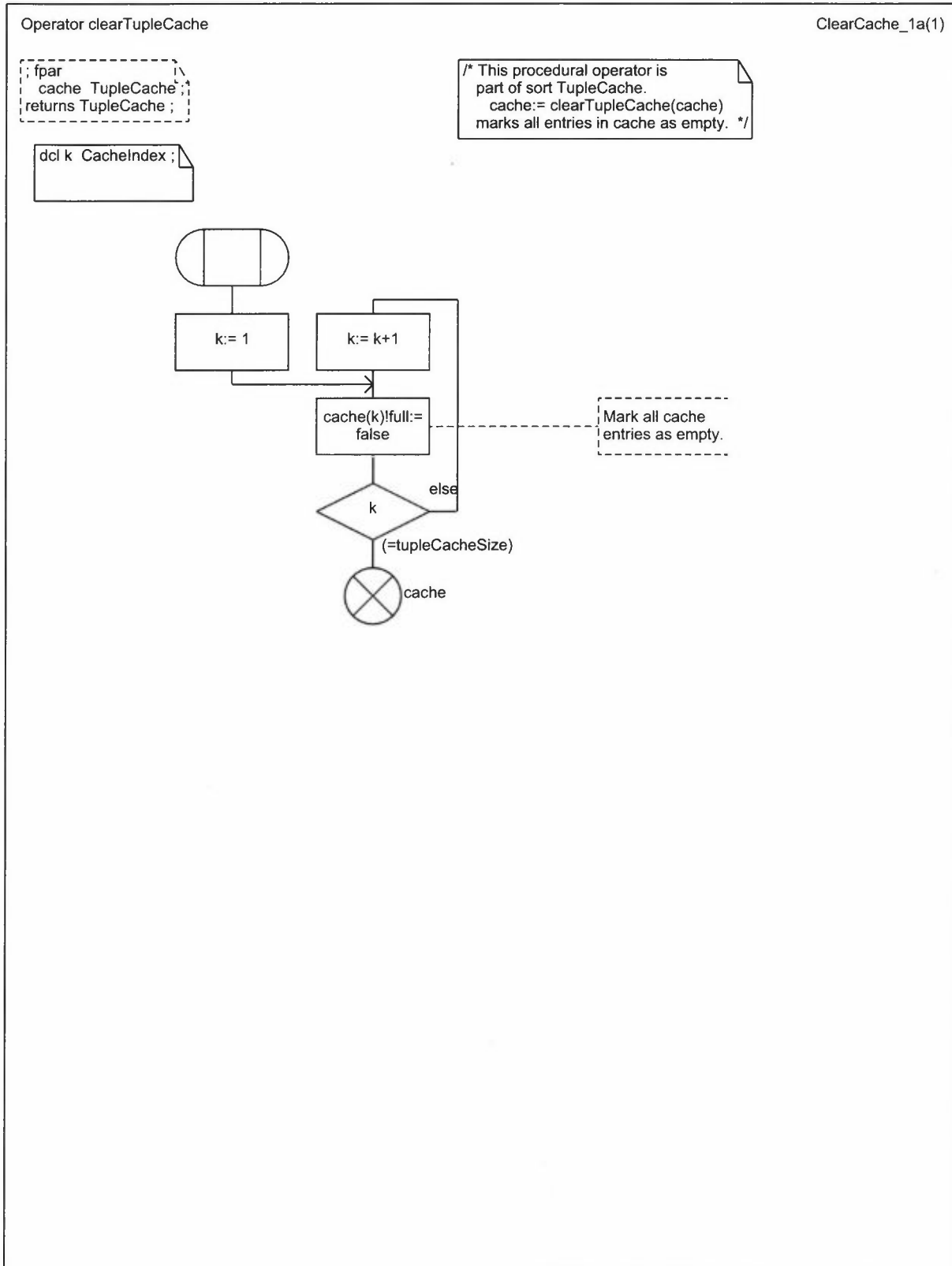
operator

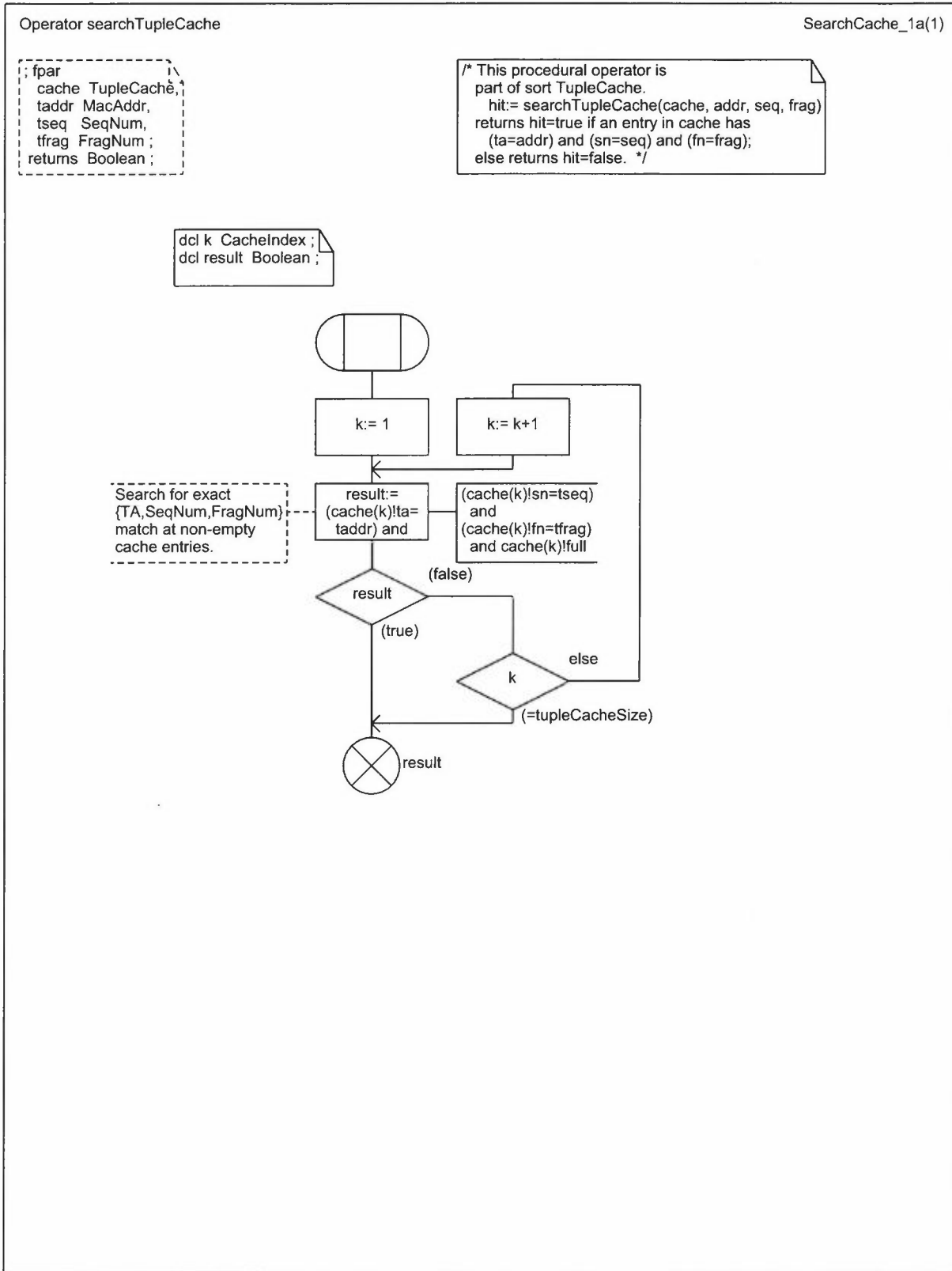
updateTupleCache

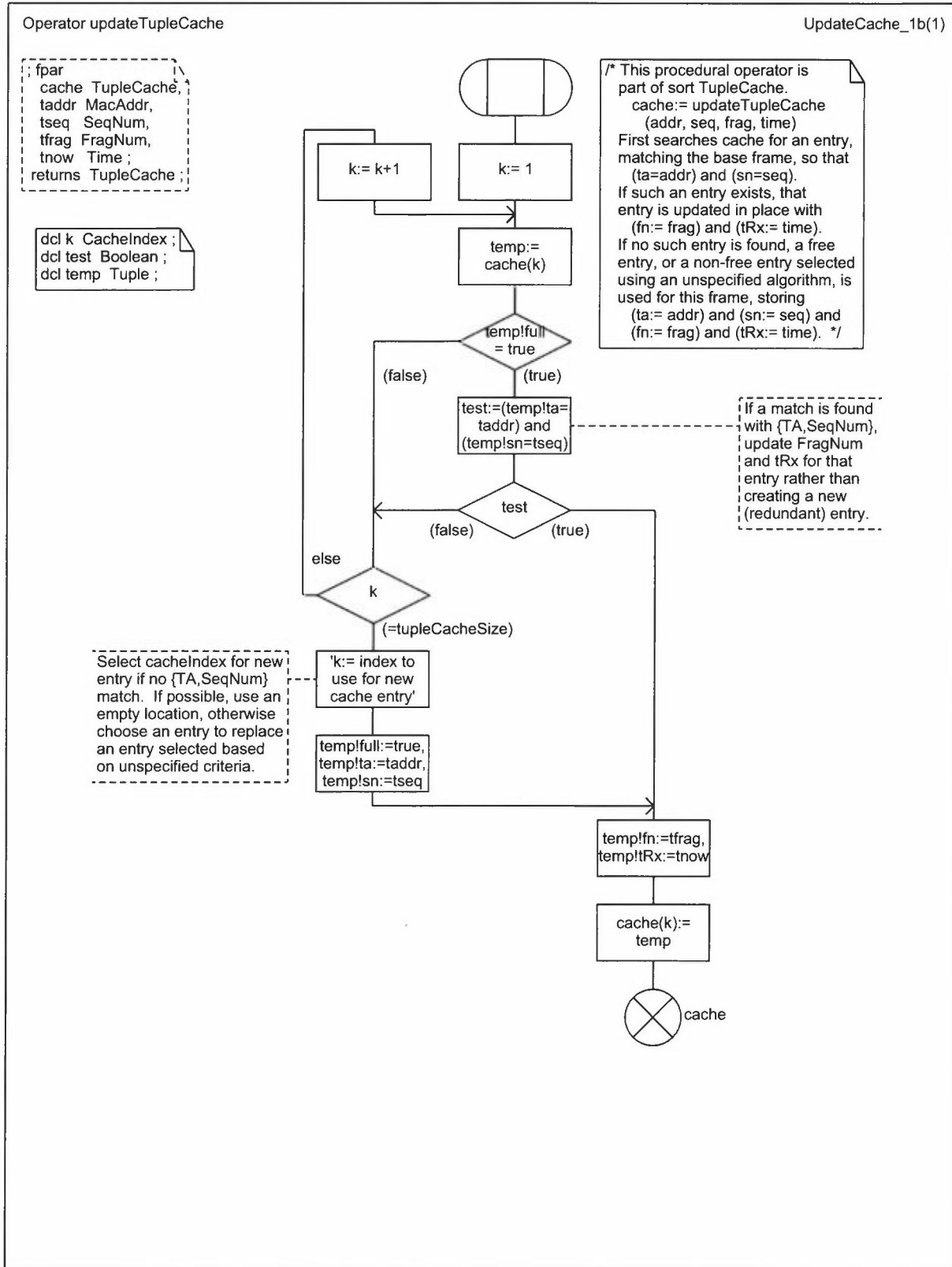
```

*****
* TupleCache support sorts
*****/
/* Number of TupleCache entries and associated index range */
synonym tupleCacheSize Integer = 32; /* this value is an example,
TupleCache size is implementation dependent */
syntype CacheIndex = Integer constants 1:tupleCacheSize
endsyntype CacheIndex;
/* TupleCache array */
/* cache:= ClearTupleCache(cache) to initialize cache */
/* cache:= UpdateTupleCache(cache, addr, seq, frag, endRx) */
/* if <addr,seq> is already cached, updates frag */
/* if <addr,seq> not cached, fills an empty entry */
/* or replaces an entry using an unspecified algorithm */
/* SearchTupleCache(cache, addr, seq, frag) */
/* returns true if specified <addr,seq,frag> in cache */
newtype TupleCache Array( CacheIndex, Tuple);
adding operators
ClearTupleCache : TupleCache -> TupleCache;
SearchTupleCache : TupleCache, MacAddr, SeqNum, FragNum -> Boolean;
UpdateTupleCache : TupleCache, MacAddr, SeqNum, FragNum, Time ->
TupleCache;
operator ClearTupleCache;
fpar cache TupleCache; returns TupleCache; referenced;
operator SearchTupleCache;
fpar cache TupleCache, taddr MacAddr, tseq SeqNum, tfrag FragNum;
returns Boolean; referenced;
operator UpdateTupleCache;
fpar cache TupleCache, taddr MacAddr, tseq SeqNum, tfrag FragNum,
tnow Time; returns TupleCache; referenced;
endnewtype TupleCache;

```









Package macsorts

3112_d\Counter(31)



```

/*****
 *   32-bit Counter sort and Integer string sort
 *****/
/* This sort used for MIB counters, needed because SDL Integers */
/* have no specified maximum value. inc(counter) increments the */
/* counter value by 1, with wraparound from (2^32)-1 to 0. */

newtype Counter32 inherits Integer operators all;
adding operators
inc : Counter32 -> Counter32;
axioms
for all c in Counter32 (
  c < 4294967295 ==> inc(c) == c + 1;
  c >= 4294967295 ==> inc(c) == 0; );
endnewtype Counter32;
/* String (1-origin) of Integer */
newtype Intstring String( Integer, noInt); endnewtype Intstring;
    
```



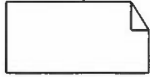
Package macsorts

3113_d\Queue(31)

```

/*****
* Generator for Queue sorts
*****/
/* The Queue generator is derived from the String0 generator */
/* to create Queues of any sort. Queues operators are: */
/* Qfirst(queue,item) adds item as the first queue element */
/* Qlast(queue,item) adds item as the last queue element */
/* and the String0 operators Length, //, First, Last, Head, Tail */
/* Because operators can only return a single value, removing an */
/* element from a queue is a 2-step process: */
/* dequeue first: item:=First(queue); queue:=Tail(queue); */
/* dequeue last: item:=Last(queue); queue:=Head(queue); */
generator Queue(type Item, literal Emptyqueue)
literals Emptyqueue;
operators
MkQ : Item -> Queue; /* make a queue from an item */
Length : Queue -> Integer; /* number of items on queue */
First : Queue -> Item; /* first item on queue */
Qfirst : Queue,Item -> Queue; /* add item as first on queue */
Tail : Queue -> Queue; /* all but first item on queue */
Last : Queue -> Item; /* last item on queue */
Qlast : Queue,Item -> Queue; /* add item as last on queue */
head : Queue -> Queue; /* all but last item on queue */
"/" : Queue, Queue -> Queue; /* concatenation */
Extract! : Queue,Integer -> Item; /* copy item from queue */
Modify! : Queue,Integer,Item -> Queue; /* modify item in queue */
SubQ : Queue,Integer,Integer -> Queue;
/* SubQ(q,i,j) queue of length j starting from queue(i) */
axioms
for all item0 in Item( for all q, q1, q2, q3 in Queue(
for all i, j in Integer(
/* constructors are Emptyqueue, MkQueue, and "/"; */
/* equalities between constructor terms */
q // Emptyqueue == q; Emptyqueue // q == q;
(q1 // q2) // q3 == q1 // (q2 // q3);
/* definition of Length by applying it to all constructors */
type Queue Length(Emptyqueue) == 0;
type Queue Length(MkQueue(item0)) == 1;
type Queue Length(q1 // q2) == Length(q1) + Length(q2);
/* definition of Extract! by applying it to all constructors, */
Extract!(MkQueue(item0), 0) == item0;
i < Length(q1) ==> Extract!(q1 // q2, i) == Extract!(q1, i);
i >= Length(q1) ==> Extract!(q1 // q2, i) == Extract!(q2, i - Length(q1));
i < 0 or i >= Length(q) ==> Extract!(q, i) == error!;
/* definition of First and Last by other operations */
First(q) == Extract!(q, 0); Last(q) == Extract!(q, Length(q) - 1);
/* definition of SubQ(q,i,j) by induction on j, */
i >= 0 and i <= Length(q) ==> SubQ(q, i, 0) == Emptyqueue;
i >= 0 and j > 0 and i + j <= Length(q) ==> SubQ(q, i, j) ==
SubQ(q, i, j - 1) // MkQueue(Extract!(q, i + j - 1));
i < 0 or j < 0 or i + j > Length(q) ==> SubQ(q,i,j) == error!;
/* define Modify!, Head, Tail, Qfirst, Qlast by other ops */
Modify!(q, i, item0) == SubQ(q, 0, l) //
MkQueue(item0) // SubQ(q, i + 1, Length(q) - i - 1);
head(q) == SubQ(q, 0, Length(q) - 1);
Tail(q) == SubQ(q, 1, Length(q) - 1);
Qfirst(q, item0) == MkQueue(item0) // q;
Qlast(q, item0) == q // MkQueue(item0); )))
endgenerator Queue;

```



Package macsorts

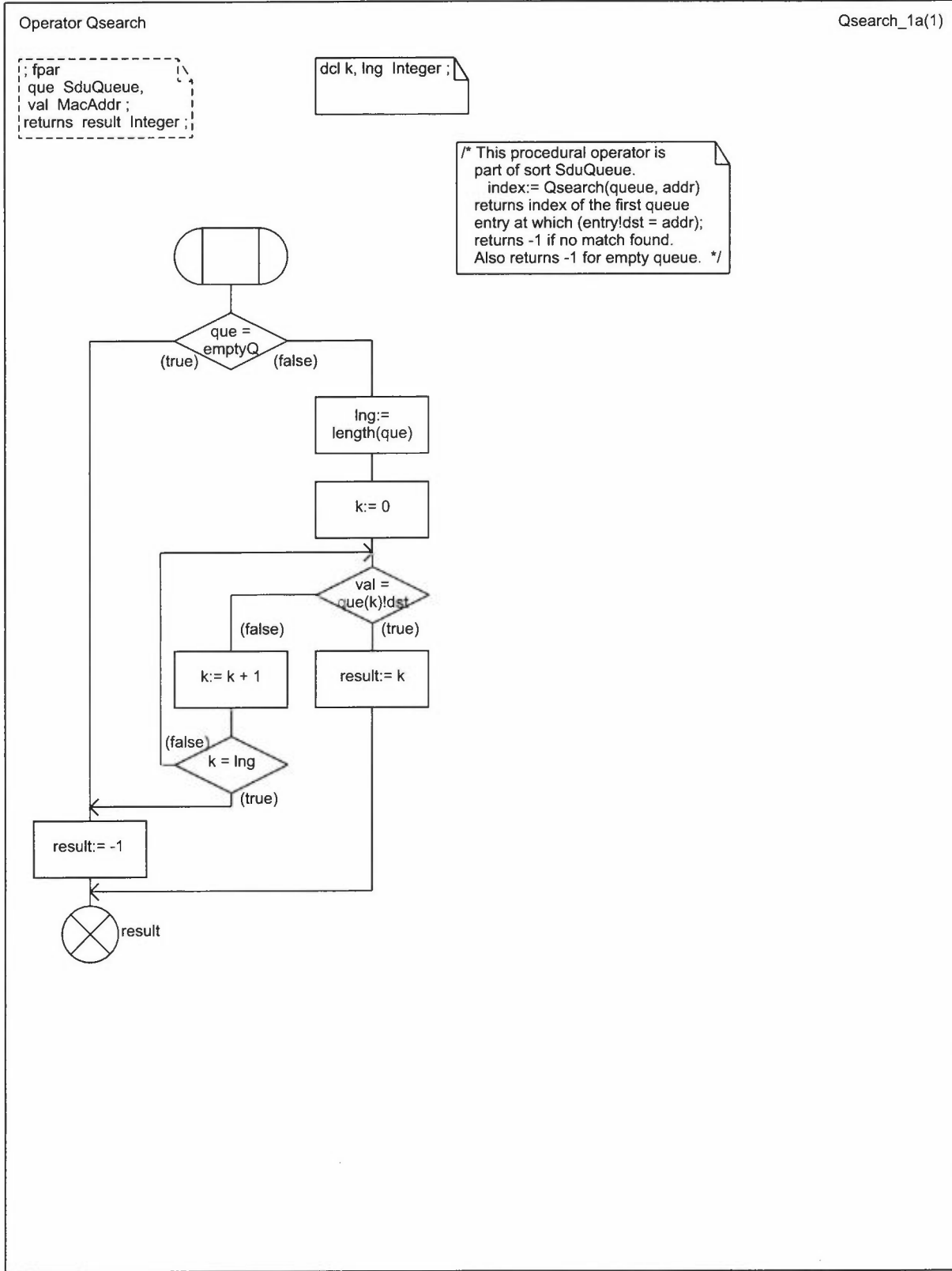
3114_d\Fragment(31)

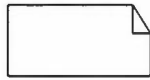


operator
qSearch

```

*****
*   Fragmentation support sorts
*****
/* Array to hold up to FragNum fragments of an Msdu/Mmpdu */
newtype FragArray Array(FragNum, Frame); endnewtype FragArray;
/* FragSdu structure is for OUTGOING MSDUs/MMPDUs (called SDUs) */
/* Each SDU, even if not fragmented, is held in an instance of */
/* this structure awaiting its (re)transmission attempt(s). */
/* Transmit queue(s) are ordered lists of FragSdu instances. */
newtype FragSdu struct
  fTot  FragNum; /* number of fragments in pdu FragArray */
  fCur  FragNum; /* next fragment number to send */
  fAnc  FragNum; /* next fragment to announce in ATIM or TIM
                 when fAnc > fCur, pdus(fCur)+ may be sent */
  eol   Time; /* set to (now + dUsec(aMaxTxMsduLifetime))
              when the entry is created */
  sqf   SeqNum; /* SDU sequence number, set at 1st Tx attempt */
  src   Integer; /* short retry counter for this SDU */
  lrc   Integer; /* long retry counter for this SDU */
  dst   MacAddr; /* destination address */
  grpa  Boolean; /* =true if RA (not DA) is a group address */
  psm   Boolean; /* =true if RA (not DA) may be in pwr_save */
  resume Boolean; /* =true if fragment burst being resumed */
  cnfTo Pld; /* address to which confirmation is sent */
  txrate Rate; /* data rate used for initial fragment */
  cf    CfPriority; /* requested priority (from LLC) */
  pdus  FragArray; /* array of Frame to hold fragments */
endnewtype FragSdu;
/* Queue of FragSdu */
/* for power save buffers, etc., searchable with Qsearch operator: */
/* index:= Qsearch(queue, addr) where queue is an SduQueue, */
/* index identifies the first queue entry at which */
/* entry!dst = addr; or as -1 if no match (or queue empty). */
newtype SduQueue Queue(FragSdu, emptyQ);
adding operators
  qSearch : SduQueue, MacAddr -> Integer;
operator qSearch;
  fpar que SduQueue, val MacAddr; returns Integer; referenced;
endnewtype SduQueue;
    
```





Package macsorts

3115_d1Defragment(31)



operator
ArAge

operator
ArFree

operator
ArSearch

```

/*****
 * Defragmentation support sorts
 *****/
/* The PartialSdu structure is for INCOMPLETE MSDUs/MMPDUs */
/* (generically SDUs) for which at least 1 fragment has been */
/* received. Unfragmented SDUs are reported upward immediately, */
/* and are never stored in instances of this structure. */
newtype PartialSdu struct
  inUse Boolean; /* =true if this instance holds any fragments */
  rta MacAddr; /* transmitting station (Addr2) */
  rsn SeqNum; /* SDU sequence number */
  rCur FragNum; /* fragment number of most recent MpdU */
  reol Time; /* (now+dUsec(aMaxReceiveLifetime) @ 1st MpdU */
  rsdu Frame; /* buffer where Mpdus are concatenated */
  default (. false, nullAddr, 0, 0, 0, null .);
endnewtype PartialSdu;
newtype PartialSduKeys struct /* if aPrivacyOptionImplemented=true */
  wDefKeys KeyVector; /* default keys when 1st frag received */
  wKeyMap KeyMapArray; /* key mappings when 1st frag received */
  wExclude Boolean; /* aExcludeUnencrypted @ 1st frag rx */
endnewtype PartialSduKeys;
/* Number of entries in defragmentation array at this station. */
/* The value is implementation dependent (min=3, see 9.5). */
synonym defragSize Integer = 6;
syntype defragIndex = Integer constants 1:defragSize
endsyntype defragIndex;
/* Array of PartialSdu for use defragmenting Msdus and Mmpdus. */
/* Searchable using the ArSearch operator */
/* index:= ArSearch(array, addr, seq, frag) */
/* where index is returned to identify the first element for which */
/* ((inUse = true) and (entry!rta = addr) and (entry!rsn = seq) */
/* and (entry!rCur = (frag-1))); or as =1 if no match found. */
/* index:= ArFree(array) returns the index of a free entry, */
/* or -1 if no entries free. May free an entry, selected using */
/* an unspecified algorithm, to avoid returning -1. */
/* array:= ArAge(array, age) */
/* frees where (entry!eol < age), also used to clear array. */
newtype DefragArray Array( defragIndex, PartialSdu);
adding operators
  ArSearch : DefragArray, MacAddr, SeqNum, FragNum -> Integer;
  ArFree : DefragArray -> Integer;
  ArAge : DefragArray, Time -> DefragArray;
operator ArSearch;
  fpar ar DefragArray, adr MacAddr, seq SeqNum, frg FragNum;
  returns Integer; referenced;
operator ArFree; fpar ar DefragArray; returns Integer; referenced;
operator ArAge; fpar ar DefragArray, age Time;
  returns DefragArray; referenced;
endnewtype DefragArray;
newtype DefragKeysArray Array( defragIndex, PartialSduKeys);
endnewtype DefragKeysArray;

```

Operator ArAge

ArAge_1a(1)

```

; fpar
ar DefragArray,
age Time ;
returns DefragArray ;
    
```

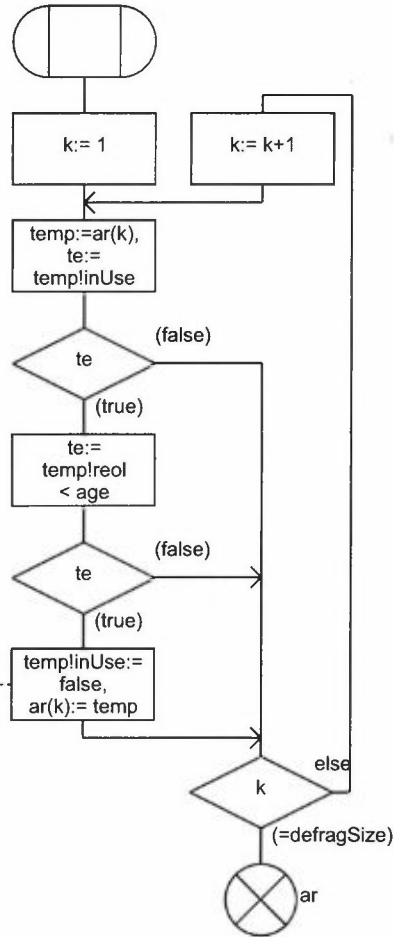
```

/* This procedural operator
is part of sort DefragArray.
array:= ArAge(array, age)
frees entries!eol < age. This is
used both for the aging function
and to clear the DefragArray. */
    
```

```

dcl k DefragIndex ;
dcl te Boolean ;
dcl temp PartialSdu ;
    
```

Mark all entries with end-of-life (eol) earlier than specified as not in use.



Operator ArFree

ArFree_1b(1)

```

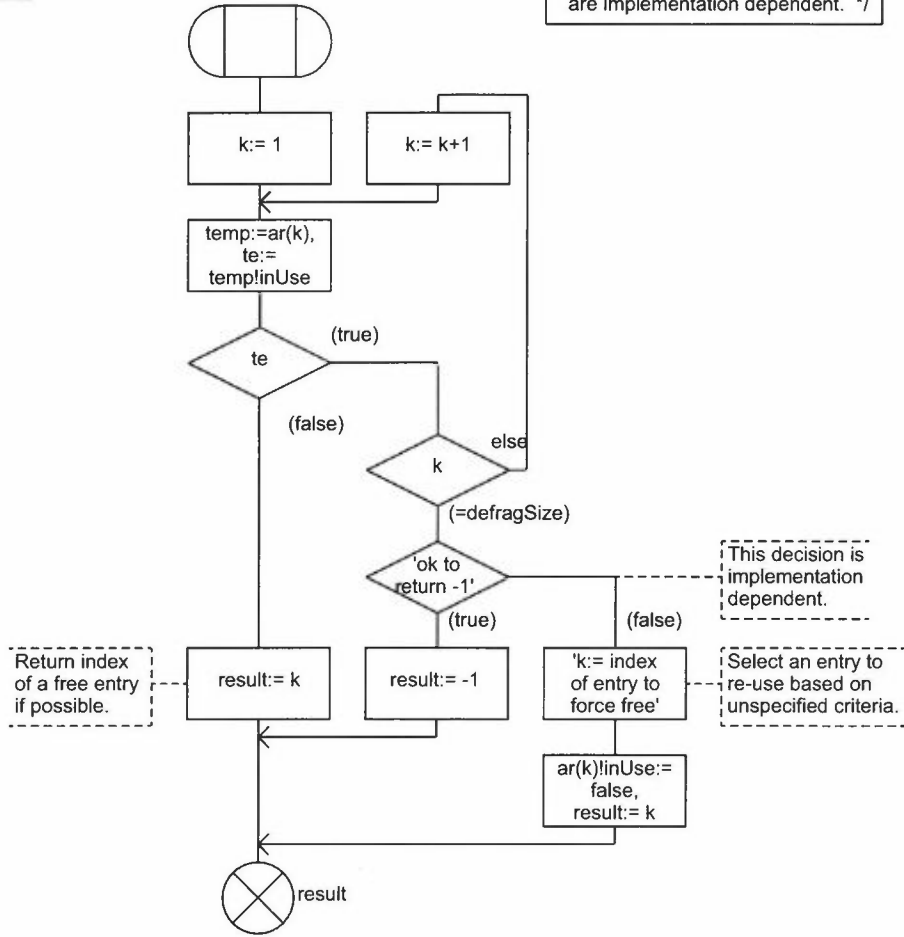
fpar
ar DefragArray
returns Integer
    
```

```

dcl k DefragIndex ;
dcl result Integer ;
dcl te Boolean ;
dcl temp PartialSdu ;
    
```

```

/* This procedural operator is
part of the sort DefragArray.
index:= ArFree(array)
returns index of an unused entry
in the array. If all entries are used,
either returns -1, or selects an
arbitrary entry to free in order to
return a usable index. Decision
criteria for case of no free entries
are implementation dependent. */
    
```



Operator ArSearch

ArSearch_1a(1)

```

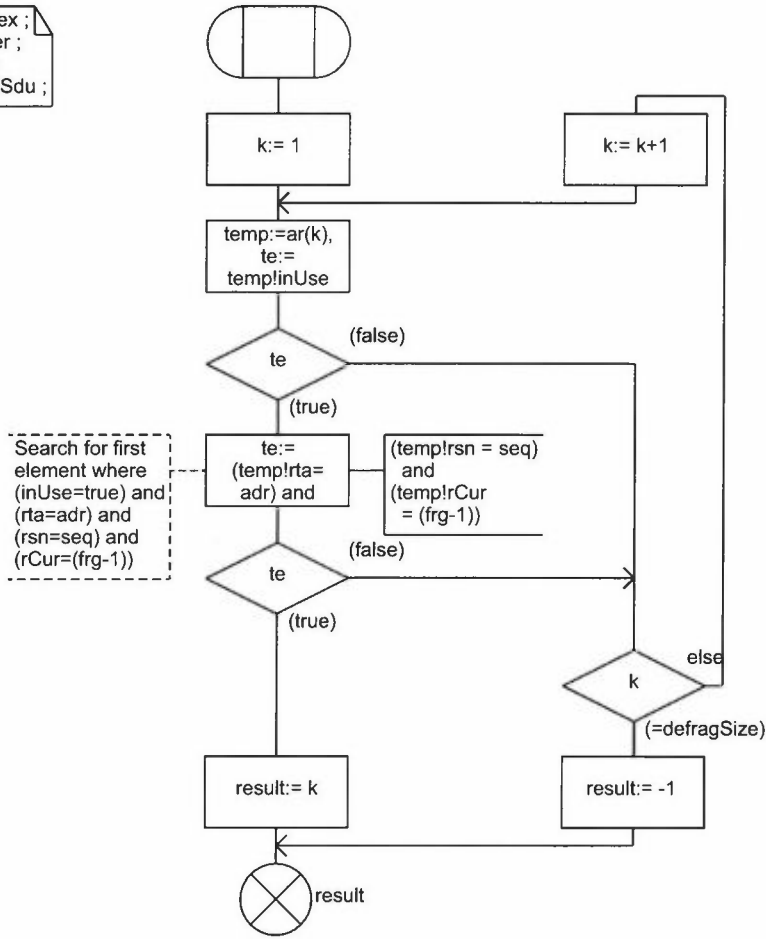
; fpar
ar DefragArray;
adr MacAddr;
seq SeqNum;
frg FragNum;
returns Integer;
    
```

```

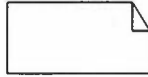
/* This procedural operator is
part of sort DefragArray.
index:= ArSearch(array, addr, seq, frag)
where array is a DefragArray;
index is returned to identify the first element
for which (inUse=true) and (entry!rta=addr) and
(entry!rsn=seq) and (entry!rCur=frag-1);
index is returned =1 if no match is found. */
    
```

```

dcl k DefragIndex;
dcl result Integer;
dcl te Boolean;
dcl temp PartialSdu;
    
```



Search for first element where (inUse=true) and (rta=adr) and (rsn=seq) and (rCur=(frg-1))



Package macsorts
3116_d1Crc_Wep(31)

operator
crc32

```

/*****
 *   CRC-32 sorts (for FCS and ICV)
 *****/
/* Crc is a subtype of Octetstring with added operators: */
/*  crc:= Crc32(crc,octet) */
/* updates the crc value to include the new octet, and */
/*  Mirror(crc), which returns a Crc value with the order */
/* of the octets, and of the bits in each octet, reversed for */
/* MSb-first transmission (see 7.1.1). Crc variables must have */
/* exactly 4 octets, which is done using initCrc or S4. */
newtype Crc inherits Octetstring operators all;
adding operators
  Crc32 : Crc, Octet -> Crc;
  mirror : Crc -> Octetstring;
operator Crc32; fpar crcin Crc, val Octet; returns Crc; referenced;
axioms  for all c in Crc(
  mirror(c) == S4(flip(c(3)),flip(c(2)),flip(c(1)), flip(c(0))); );
endnewtype Crc;
synonym initCrc Crc = /* Initial Crc value (all 1s) */
  << type Crc>> S4(0xFF,0xFF,0xFF,0xFF);
synonym goodCrc Crc = /* Unique remainder for valid CRC-32 */
  << type Crc>> S4(0x7B,0xDD,0x04,0xC7);

```

operator
keyLookup

```

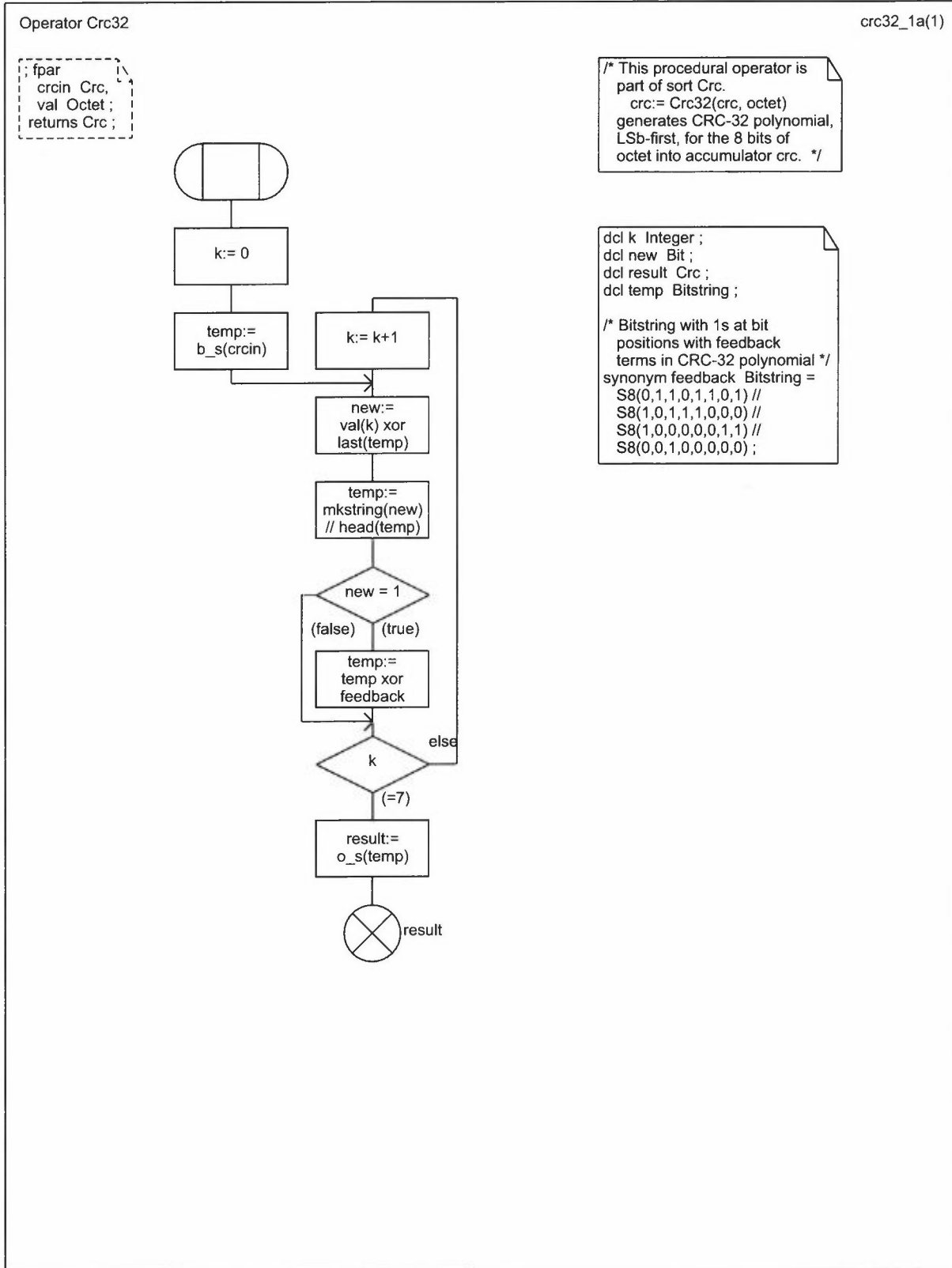
/*****
 *   WEP support sorts
 *****/
syntype KeyIndex = Integer constants 0:3 endsyntype KeyIndex;
newtype PrngKey inherits Octetstring operators all;
adding literals nullKey; /* nullKey is not any of 2^40 key values */
axioms nullKey == null; default nullKey; endnewtype PrngKey;
newtype KeyVector /* vector of default WEP keys */
  Array( KeyIndex, PrngKey); endnewtype KeyVector;
/* Number of entries in aWepKeyMappings array at this station.
/* implementation dependent value, minimum=10 (see 8.3.2). */
synonym sWepKeyMappingLength Integer = 10;
syntype KeyMappingRange = Integer
  constants 1:sWepKeyMappingLength endsyntype KeyMappingRange;
newtype KeyMap struct /* structure used for entries in KeyMapArray */
  mappedAddr MacAddr;
  wepOn Boolean;
  wepKey PrngKey;
endnewtype KeyMap;
/* KeyMapArray -- used for aWepKeyMapping table; */
/* an array of KeyMap indexed by KeyMappingRange, with operator */
/* KeyMap := keyLookup(addr, keyMapArray, keyMapArrayLength) */
/* returns the KeyMap entry for the specified addr, or */
/* (. nullAddr, false, nullKey .) if no mapping for addr. */
newtype KeyMapArray Array( KeyMappingRange, KeyMap);
adding operators
  keyLookup : MacAddr, KeyMapArray, Integer -> KeyMap;
operator keyLookup;
fpar luadr MacAddr, kma KeyMapArray, kml Integer;
returns KeyMap; referenced;
endnewtype KeyMapArray;

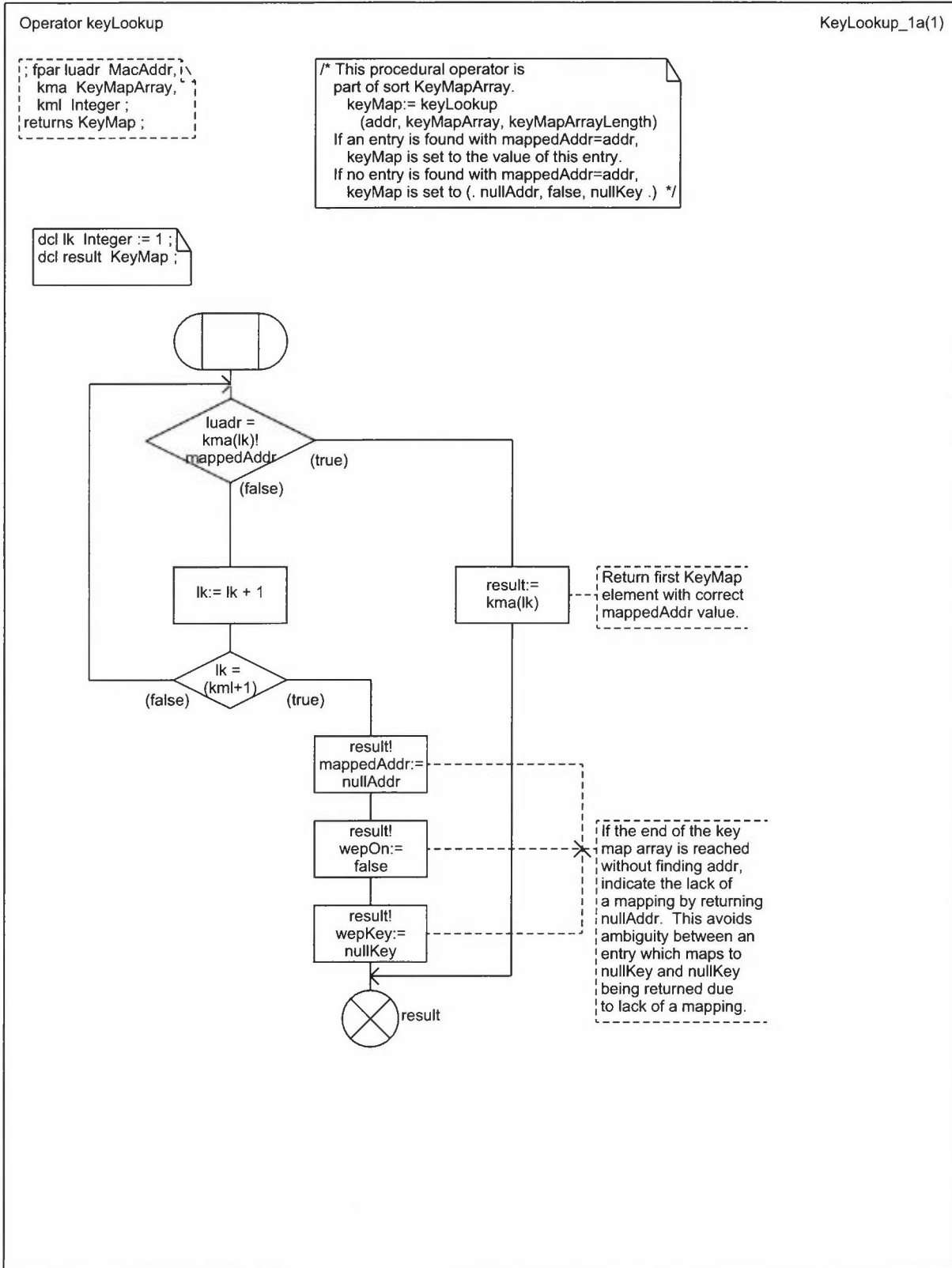
```

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301

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Package macsorts

3117_d\Frame_1(31)

```

/*****
 *   FRAME sort (the basic definition of fields in MAC frames)
 *****/
/* Frame is a subtype of Octetstring with operators for creating
/* MAC headers, extracting each of the header fields and some
/* management frame fields, and modifying most of these fields.
/* There are operators to create and extract management frame
/* elements, but no operators for the frame body, IV, ICV, and FCS
/* fields, which are handled directly as Octetstrings. */
newtype Frame inherits Octetstring operators all;
adding operators
mkFrame : TypeSubtype, MacAddr, MacAddr, Octetstring -> Frame;
mkCtl : TypeSubtype, Octetstring, MacAddr -> Frame;
protocolVer : Frame -> Integer; /* Protocol version (2 bits) */
basetype : Frame -> BasicType; /* Type field (2 bits) */
ftype : Frame -> TypeSubtype; /* Type & Subtype (6 bits) */
setFtype : Frame, TypeSubtype -> Frame;
toDs : Frame -> Bit; /* To DS bit (1 bit) */
setToDs : Frame, Bit -> Frame;
frDs : Frame -> Bit; /* From DS bit (1 bit) */
setFrDs : Frame, Bit -> Frame;
moreFrag : Frame -> Bit; /* More Fragments bit (1 bit) */
setMoreFrag : Frame, Bit -> Frame;
retryBit : Frame -> Bit; /* Retry bit (1 bit) */
setRetryBit : Frame, Bit -> Frame;
pwrMgt : Frame -> Bit; /* Power Management bit (1 bit) */
setPwrMgt : Frame, Bit -> Frame;
moreData : Frame -> Bit; /* More Data bit (1 bit) */
setMoreData : Frame, Bit -> Frame;
wepBit : Frame -> Bit; /* WEP bit (1 bit) */
setWepBit : Frame, Bit -> Frame;
orderBit : Frame -> Bit; /* {strictly}Order{ed} (1 bit) */
setOrderBit : Frame, Bit -> Frame;
durlId : Frame -> Integer; /* Duration/ID field (2) */
setDurlId : Frame, Integer -> Frame;
addr1 : Frame -> MacAddr; /* Address 1 [DA/RA] field (6) */
setAddr1 : Frame, MacAddr -> Frame;
addr2 : Frame -> MacAddr; /* Address 2 [SA/TA] field (6) */
setAddr2 : Frame, MacAddr -> Frame;
addr3 : Frame -> MacAddr; /* Address 3 [Bss/DA/SA] field */
setAddr3 : Frame, MacAddr -> Frame;
addr4 : Frame -> MacAddr; /* Address 4 [WDS-SA] field (6) */
insAddr4 : Frame, MacAddr -> Frame;
seq : Frame -> SeqNum; /* Sequence Number (12 bits) */
setSeq : Frame, SeqNum -> Frame;
frag : Frame -> FragNum; /* Fragment Number (4 bits) */
setFrag : Frame, FragNum -> Frame;
ts : Frame -> Time; /* Timestamp field (8) */
setTs : Frame, Time -> Frame;
mkElem : ElementID, Octetstring -> Frame; /* make element */
GetElem : Frame, ElementID -> Frame; /* get element if aval */
status : Frame -> StatusCode; /* Status Code field (2) */
setStatus : Frame, StatusCode -> Frame;
authStat : Frame -> StatusCode; /* Status Code in Auth frame */
reason : Frame -> ReasonCode; /* Reason Code field (2) */

/* Frame operators continued on next page ...*/

```

operator
getElem

Gets element
from body of
Management
frame. If the
target element
is not present
an Octetstring
of length zero
is returned.



Package macsorts

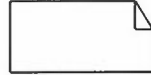
3118_dIFrame_2(31)

```

/* ...Frame Sort Operators continued */
authSeqNum : Frame -> Integer; /* Auth Sequence Number (2) */
authAlg : Frame -> AuthType; /* Auth Algorithm field (2) */
beaconInt : Frame -> TU; /* Beacon Interval field (2) */
listenInt : Frame -> TU; /* Listen Interval field (2) */
Ald : Frame -> AsocId; /* Association ID field (2) */
setAld : Frame, AsocId -> Frame;
curApAddr : Frame -> MacAddr; /* Current AP Addr field (6) */
capA : Frame, Capability -> Bit; /* Capability (Re)Asoc */
setCapA : Frame, Capability, Bit -> Frame;
capB : Frame, Capability -> Bit; /* Capability Bcn/Probe */
setCapB : Frame, Capability, Bit -> Frame;
keyId : Frame -> KeyIndex; /* Key ID subfield (2 bits) */
setKeyId : Frame, KeyIndex -> Frame;
operator GetElem;
fpar fr Frame, el ElementID; returns Frame; referenced;
    
```

```

/* Frame Sort Axioms */
axioms
for all f in Frame(
  for all a, sa, da, ra, ta, bssa in MacAddr(
    for all body, dur, sid, info in Octetstring(
      addr1(f) == SubStr(f,4,6);
      setAddr1(f,a) == SubStr(f,0,4) // a // SubStr(f,10,Length(f)-10);
      addr2(f) == SubStr(f,10,6);
      setAddr2(f,a) == SubStr(f,0,10) // a // SubStr(f,16,Length(f)-16);
      addr3(f) == SubStr(f,16,6);
      setAddr3(f,a) == SubStr(f,0,16) // a // SubStr(f,22,Length(f)-22);
      addr4(f) == SubStr(f,24,6);
      insAddr4(f,a) == SubStr(f,0,24) // a // SubStr(f,24,Length(f)-24);
      curApAddr(f) == SubStr(f,28,6);
      for all ft in TypeSubtype(
        mkFrame(ft, da, bssa, body) ==
          ft // O3 // da // dot11MacAddress // bssa // O2 // body;
        (ft = rts) ==> mkCtl(ft, dur, ra) ==
          ft // O1 // dur // ra // aStationID;
        (ft = ps_poll) ==> mkCtl(ft, sid, bssa) ==
          ft // O1 // sid // bssa // aStationID;
        (ft = cts) or (ft = ack) ==> mkCtl(ft, dur, ra) ==
          ft // O1 // dur // ra;
        (ft = cfend) or (ft = cfend_ack) ==> mkCtl(ft, bssa, ra) ==
          ft // O3 // ra // bssa;
        ftype(f) == MkString(f(0) and 0xFC);
        setFtype(f, ft) == Modify!(f, 0, MkString((f(0) and 0x03) or
          ft)); );
      for all bt in BasicType(
        basetype(f) == f(0) and 0x0C; );
      for all i in Integer(
        protocolVer(f) == octetVal(f(0) and 0x03);
        authSeqNum(f) == octetVal(f(26)) + (octetVal(f(27)) * 256);
        durId(f) == octetVal(f(2)) + (octetVal(f(3)) * 256);
        setDurId(f, i) == SubStr(f, 0, 2) // mkOS(i mod 256, 1) //
          mkOS(i / 256, 1) // SubStr(f, 4, Length(f) - 4); );
      for all e in ElementID(
        mkElem(e, info) == e // mkOS(Length(info) + 2, 1) // info; );
    )
  )
)
/* Frame Sort Axioms continued on next page ... */
    
```



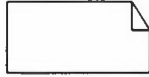
Package macsorts

3119_d\Frame_3(31)

```

/* ... Frame Sort Axioms continued */
for all b in Bit(
  toDs(f) == if (f(1) and 0x01) then 1 else 0 fi;
  setToDs(f, b) ==
    Modify!(f, 1, (f(1) and 0xFE) or S8(0,0,0,0,0,0,0,b));
  frDs(f) == if (f(1) and 0x02) then 1 else 0 fi;
  setFrDs(f, b) ==
    Modify!(f, 1, (f(1) and 0xFD) or S8(0,0,0,0,0,0,0,b));
  moreFrag(f) == if (f(1) and 0x04) then 1 else 0 fi;
  setMoreFrag(f, b) ==
    Modify!(f, 1, (f(1) and 0xFB) or S8(0,0,0,0,0,0,0,b));
  retryBit(f) == if (f(1) and 0x08) then 1 else 0 fi;
  setRetryBit(f, b) ==
    Modify!(f, 1, (f(1) and 0xF7) or S8(0,0,0,0,b,0,0,0));
  pwrMgt(f) == if (f(1) and 0x10) then 1 else 0 fi;
  setPwrMgt(f, b) ==
    Modify!(f, 1, (f(1) and 0xFB) or S8(0,0,0,b,0,0,0,0));
  moreData(f) == if (f(1) and 0x20) then 1 else 0 fi;
  setMoreData(f, b) ==
    Modify!(f, 1, (f(1) and 0xFB) or S8(0,0,b,0,0,0,0,0));
  wepBit(f) == if (f(1) and 0x40) then 1 else 0 fi;
  setWepBit(f, b) ==
    Modify!(f, 1, (f(1) and 0xFB) or S8(0,b,0,0,0,0,0,0));
  orderBit(f) == if (f(1) and 0x80) then 1 else 0 fi;
  setOrderBit(f, b) ==
    Modify!(f, 1, (f(1) and 0xFB) or S8(b,0,0,0,0,0,0,0));
for all c in Capability(
  capA(f,c) == if (B_S(SubStr(f,24,2)) and c) then 1 else 0 fi;
  setCapA(f,c,b) == SubStr(f,0,24) // (B_S(SubStr(f,24,2) and
  (not c)) or (if b then c else O2 fi)) //
  SubStr(f,26,Length(f) - 26);
  capB(f,c) == if (B_S(SubStr(f,34,2)) and c) then 1 else 0 fi;
  setCapB(f,c,b) == SubStr(f,0,34) // (B_S(SubStr(f,34,2) and
  (not c)) or (if b then c else O2 fi)) //
  SubStr(f,36,Length(f) - 36); );
for all sq in SeqNum(
  seq(f) == (octetVal(f(22) and 0xF0)/16)+(octetVal(f(23)*16));
  setSeq(f, sq) == SubStr(f, 0, 22) // MkString((f(22) and 0x0F)
  or mkOctet(sq mod 16) * 16) // mkOS(sq / 16, 1) //
  SubStr(f, 24, Length(f) - 24); );
for all fr in FragNum(
  frag(f) == octetVal(f(22) and 0x0F);
  setFrag(f, fr) ==
    SubStr(f, 0, 22) // MkString((f(22) and 0xF0) or
    mkOctet(fr)) // SubStr(f, 23, Length(f) - 23); );
for all tm in Time(
  ts(f) == tUsec( Usec!(octetVal(f(24)) +
    (256 * (octetVal(f(25)) +
    (256 * (octetVal(f(26)) +
    (256 * (octetVal(f(27)) +
    (256 * (octetVal(f(28)) +
    (256 * (octetVal(f(29)) +
    (256 * (octetVal(f(30)) +
    (256 * octetVal(f(31)))))))))))))) );
/* Frame Sort Axioms continued on next page ... */

```



Package macsorts

3120_dIFrame_4(31)



```

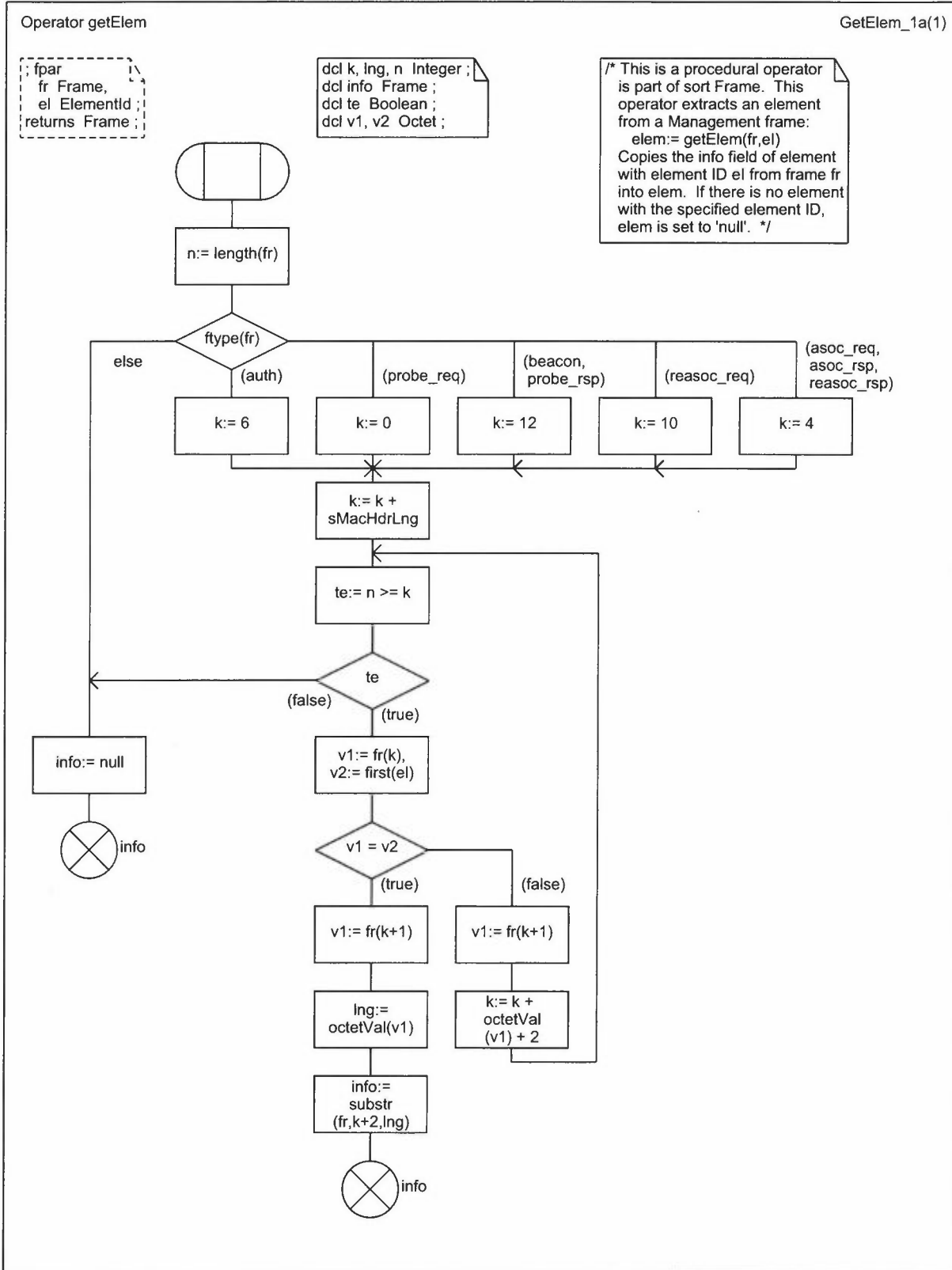
/* ... Frame Sort Axioms continued */
setTs(f, tm) == SubStr(f, 0, 24) // mkOS(fix(tm), 1) //
mkOS((fix(tm) / 256), 1) // mkOS((fix(tm) / 65536), 1) //
mkOS((fix(tm) / 16777216), 1) //
mkOS((fix(tm) / 4294967296), 1) //
mkOS(((fix(tm) / 4294967296) / 256), 1) //
mkOS(((fix(tm) / 4294967296) / 65536), 1) //
mkOS(((fix(tm) / 4294967296) / 16777216), 1) //
SubStr(f, 32, Length(f) - 32); );
for all stat in StatusCode(
status(f) == SubStr(f, 26, 2);
setStatus(f, stat) ==
SubStr(f, 0, 26) // stat // SubStr(f, 28, Length(f) - 28);
authStat(f) == SubStr(f, 28, 2); );
for all rea in ReasonCode( reason(f) == SubStr(f, 24, 2); );
for all alg in AuthType( AuthType(f) == SubStr(f, 24, 2); );
for all u in TU(
beaconInt(f) == octetVal(f(32)) + (octetVal(f(33)) * 256);
listenInt(f) == octetVal(f(26)) + (octetVal(f(27)) * 256); );
for all sta in AssocId(
Aid(f) == octetVal(f(28)) + (octetVal(f(29)) * 256);
setAid(f, sta) == SubStr(f, 0, 28) // mkOS(sta mod 256, 1) //
mkOS(sta / 256, 1) // SubStr(f, 30, Length(f) - 30); );
for all kid in KeyIndexRange(
keyId(f) == octetVal(f(27)) / 64;
setKeyId(f, kid) == Modify!(f, 27, mkOS(kid * 64)); ); );
endnewtype Frame;
    
```

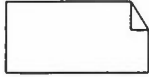
```

/*****
* ReasonCode sort
*****/
newtype ReasonCode inherits Octetstring operators all;
adding literals unspec_reason, auth_not_valid, deauth_lv_ss,
inactivity, ap_overload, class2_err, class3_err,
disas_lv_ss, asoc_not_auth;
axioms
unspec_reason == mkOS(1, 2); auth_not_valid == mkOS(2, 2);
deauth_lv_ss == mkOS(3, 2); inactivity == mkOS(4, 2);
ap_overload == mkOS(5, 2); class2_err == mkOS(6, 2);
class3_err == mkOS(7, 2); disas_lv_ss == mkOS(8, 2);
asoc_not_auth == mkOS(9, 2);
endnewtype ReasonCode;
    
```

```

/*****
* StatusCode sort
*****/
newtype StatusCode inherits Octetstring operators all;
adding literals successful, unspec_fail, unsup_cap,
reasoc_no_asoc, fail_other, unsupt_alg, auth_seq_fail,
ching_fail, auth_timeout, ap_full, unsup_rate;
axioms
successful == mkOS(0, 2); unspec_failure == mkOS(1, 2);
unsup_cap == mkOS(10, 2); reasoc_no_asoc == mkOS(11, 2);
fail_other == mkOS(12, 2); unsupt_alg == mkOS(13, 2);
auth_seq_fail == mkOS(14, 2); ching_fail == mkOS(15, 2);
auth_timeout == mkOS(16, 2); ap_full == mkOS(17, 2);
unsup_rate == mkOS(18, 2);
endnewtype StatusCode;
    
```





Package macsorts

3121_d\FrameType(31)



```

/*****
 *      Frame Type sorts
 *****/
/* TypeSubtype defines the full, 6-bit frame type identifiers. */
/* These values are useful with ftype operator of Frame sort. */
newtype TypeSubtype inherits Octetstring operators all;
adding literals asoc_req, asoc_rsp, reasoc_req, reasoc_rsp,
    probe_req, probe_rsp, beacon, atim, disasoc, auth, deauth,
    ps_poll, rts, cts, ack, cfend, cfend_ack, data, data_ack,
    data_poll, data_poll_ack, null_frame, cfack, cfpoll, cfpoll_ack;
axioms
asoc_req == MkString(S8(0,0,0,0,0,0,0,0));
asoc_rsp == MkString(S8(0,0,0,0,1,0,0,0));
reasoc_req == MkString(S8(0,0,0,0,0,1,0,0));
reasoc_rsp == MkString(S8(0,0,0,0,1,1,0,0));
probe_req == MkString(S8(0,0,0,0,0,0,1,0));
probe_rsp == MkString(S8(0,0,0,0,1,0,1,0));
beacon == MkString(S8(0,0,0,0,0,0,0,1));
atim == MkString(S8(0,0,0,0,1,0,0,1));
disasoc == MkString(S8(0,0,0,0,0,0,1,0,1));
auth == MkString(S8(0,0,0,0,1,1,0,1));
deauth == MkString(S8(0,0,0,0,0,0,1,1));
ps_poll == MkString(S8(0,0,1,0,0,1,0,1));
rts == MkString(S8(0,0,1,0,1,1,0,1));
cts == MkString(S8(0,0,1,0,0,0,1,1));
ack == MkString(S8(0,0,1,0,1,0,1,1));
cfend == MkString(S8(0,0,1,0,0,1,1,1));
cfend_ack == MkString(S8(0,0,1,0,1,1,1,1));
data == MkString(S8(0,0,0,1,0,0,0,0));
data_ack == MkString(S8(0,0,0,1,1,0,0,0));
data_poll == MkString(S8(0,0,0,1,0,1,0,0));
data_poll_ack == MkString(S8(0,0,0,1,1,1,0,0));
null_frame == MkString(S8(0,0,0,1,0,0,1,0));
cfack == MkString(S8(0,0,0,1,1,0,1,0));
cfpoll == MkString(S8(0,0,0,1,0,1,1,0));
cfpoll_ack == MkString(S8(0,0,0,1,1,1,1,0));
endnewtype TypeSubtype;
/* BasicTypes defines the 2-bit frame type groups */
newtype BasicType inherits Bitstring operators all;
adding literals control, data, management, reserved;
axioms
control == S8(0,0,1,0,0,0,0,0); data == S8(0,0,0,1,0,0,0,0);
management == S8(0,0,0,0,0,0,0,0); reserved == S8(0,0,1,1,0,0,0,0);
endnewtype BasicType;

```



Package macsorts

3122_d\MgmtFields(31)



```

/*****
 *   ElementID sort
 *****/
newtype ElementID inherits Octetstring operators all;
adding literals eSsId, eSupRates, eFhParms, eDsParms,
eCfParms, eTim, elbParms, eCtext;
axioms
eSsId == mkOS(0, 1); /* service set identifier (0:32) */
eSupRates == mkOS(1, 1); /* supported rates (1:8) */
eFhParms == mkOS(2, 1); /* FH parameter set (5) */
eDsParms == mkOS(3, 1); /* DS parameter set (1) */
eCfParms == mkOS(4, 1); /* CF parameter set (6) */
eTim == mkOS(5, 1); /* Traffic Information Map (4:254) */
elbParms == mkOS(6, 1); /* IBSS parameter set (2) */
eCtext == mkOS(16, 1); /* challenge text (128, see 8.1.2.2) */
endnewtype ElementID;

```

```

/*****
 *   Capability field bit assignments sort
 *****/
newtype Capability inherits Bitstring operators all;
adding literals cEss, cbss, cPollable, cPollReq, cPrivacy;
axioms
cEss == S8(1,0,0,0,0,0,0,0) // 0x00; /* ESS capability */
cbss == S8(0,1,0,0,0,0,0,0) // 0x00; /* IBSS capability */
cPollable == S8(0,0,1,0,0,0,0,0) // 0x00; /* CF-pollable (sta), PC present (ap) */
cPollReq == S8(0,0,0,1,0,0,0,0) // 0x00; /* not CF poll req (sta), PC polls (ap) */
cPrivacy == S8(0,0,0,0,1,0,0,0) // 0x00; /* WEP required */
endnewtype Capability;

```

```

/*****
 *   IBSS parameter set sort
 *****/
newtype IbssParms inherits Octetstring operators all;
adding operators
atimWin : IbssParms -> TU;
setAtimWin : IbssParms, TU -> IbssParms;
axioms
for all ib in IbssParms( for all u in TU(
  atimWin(ib) == octetVal(ib(0)) + (octetVal(ib(1)) * 256);
  setAtimWin(ib, u) == mkOS(u mod 256, 1) // mkOS(u / 256, 1); );
endnewtype IbssParms;

```



Package macsorts

3123_d\CF_And_AsocParams(31)



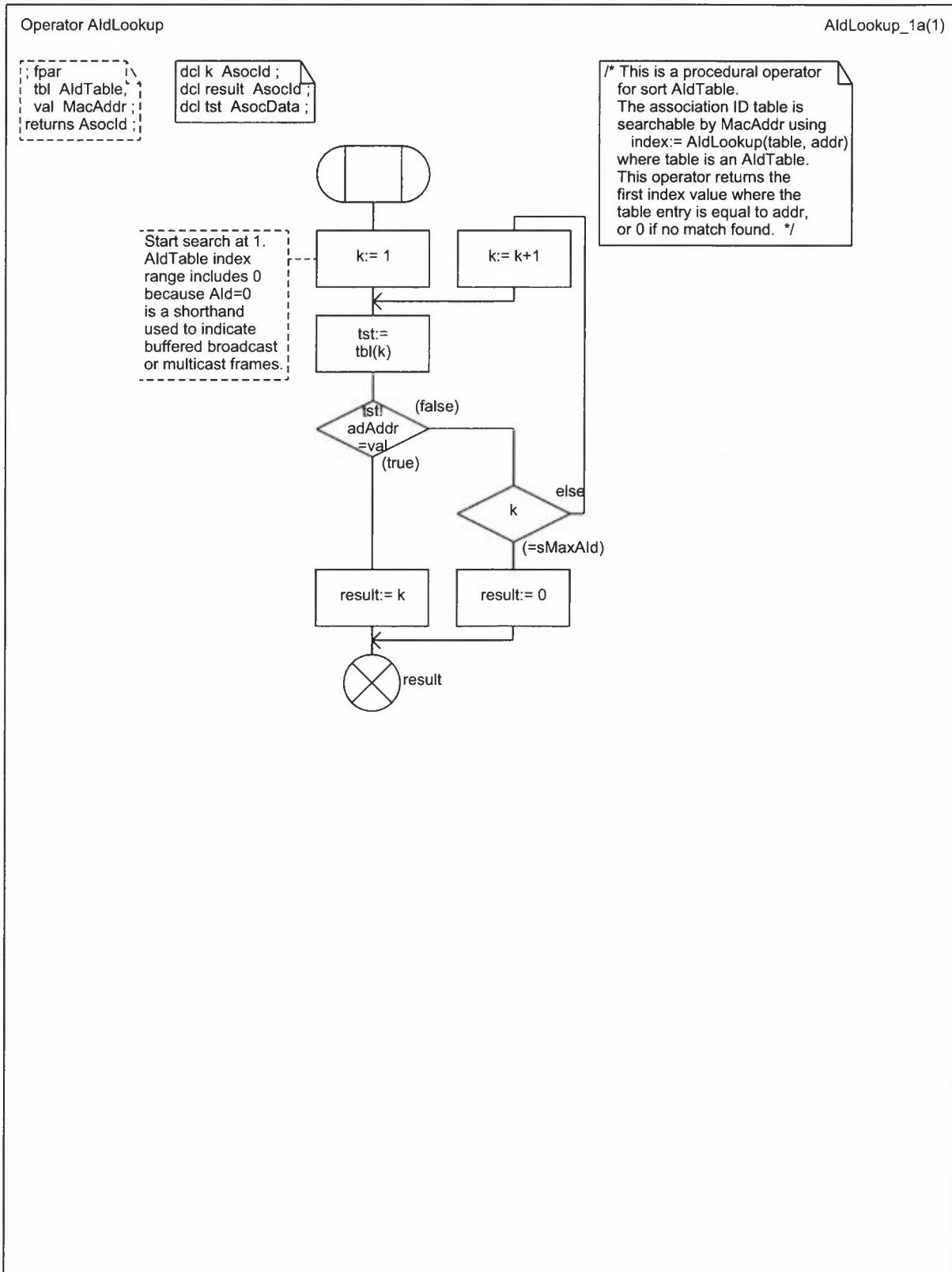
```

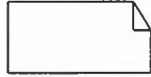
/*****
 *   CF parameter set sort
 *****/
newtype CfParms inherits Octetstring operators all;
adding operators
  cfpCount : CfParms -> Integer; /* CfpCount field (1) */
  setCfpCount : CfParms, Integer -> CfParms;
  cfpPeriod : CfParms -> Integer; /* CfpPeriod field (1) */
  setCfpPeriod : CfParms, Integer -> CfParms;
  cfpMaxDur : CfParms -> TU; /* CfpMaxDuration field (2) */
  setCfpMaxDur : CfParms, TU -> CfParms;
  cfpDurRem : CfParms -> TU; /* CfpDurRemaining field (2) */
  setCfpDurRem : CfParms, TU -> CfParms;
axioms for all cf in CfParms( for all i in Integer( for all u in TU(
  cfpCount(cf) == octetVal(cf(0));
  setCfpCount(cf, i) == mkOS(i, 1) // Tail(cf);
  cfpPeriod(cf) == octetVal(cf(1));
  setCfpPeriod(cf, i) == cf(0) // mkOS(i, 1) // SubStr(cf,2,4);
  cfpMaxDur(cf) == octetVal(cf(2)) + (octetVal(cf(3)) * 256);
  setCfpMaxDur(cf, u) == SubStr(cf, 0, 2) // mkOS(u mod 256, 1)
    // mkOS(u / 256, 1) // SubStr(cf, 4, 2);
  cfpDurRem(cf) == octetVal(cf(4)) + (octetVal(cf(5)) * 256);
  setCfpDurRem(cf, u) == SubStr(cf, 0, 4) // mkOS(u mod 256, 1)
    // mkOS(u / 256, 1); ));
endnewtype CfParms;
    
```

operator
AldLookup

```

/*****
 *   Sorts for association management at AP
 *****/
synonym sMaxAld Integer = 2007; /* 2007 is largest allowable value */
/* implementation limit may be lower */
syntype AsocId = Integer constants 0:sMaxAld endsyntype AsocId;
/* Station Association Record -- only used at APs */
newtype AsocData struct
  adAddr MacAddr; /* address of associated station */
  adPsm PwrSave; /* power save mode of the station */
  adCfPoll Boolean; /* true if station is CfPollable */
  adPollRq Boolean; /* true if station requested polling */
  adNoPoll Boolean; /* true if station requested no polling */
  adMsduIP Boolean; /* true if partial Msdu outstanding to sta */
  adAuth AuthType; /* authentication type used by station */
  adRates RateSet; /* supported rates from association request */
  adAge Time; /* time of association */
endnewtype AsocData;
/* Association table -- array of AsocData, only used at APs */
/* index:= AldLookup(table, addr) */
/* returns the index of location where table(x).adAddr=addr */
/* or 0 if no such location found. */
newtype AldTable Array(AsocId, AsocData);
adding operators
  AldLookup : AldTable, MacAddr -> AsocId;
operator AldLookup;
  fpar tbl AldTable, val MacAddr; returns AsocId; referenced;
endnewtype AldTable;
    
```





Package macsorts

3124_d\TIM(31)



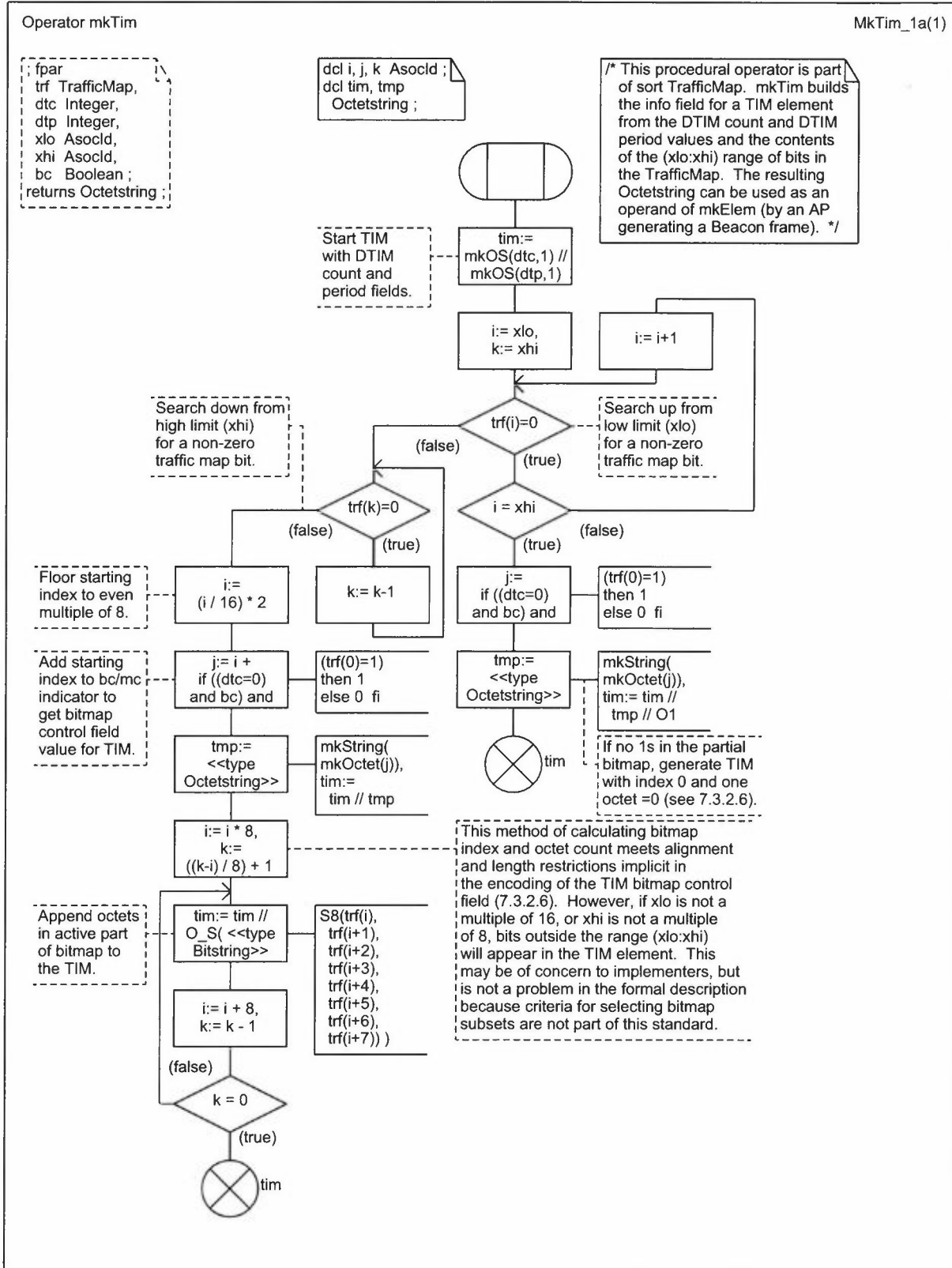
operator
mkTim

operator
nextAld

```

*****
*   Traffic Information Map (TIM) support sorts
*****/
/* TrafficMap is an Array of Bit indexed by Ald. */
/* Bits =1 in TrafficMap denote the presence of buffered frame(s) */
/* for the station assigned that Ald. TrafficMap operators are: */
/* mkTim(trafficMap, dtimCnt, dtimPer, lowAld, highAld, bcst) */
/* returns Octetstring to use as the info field of a TIM element */
/* The TIM will contain bits =1 for TrafficMap locations in the */
/* range (lowAld):(highAld). Buffered broadcasts and multicasts */
/* (Ald 0) are indicated if dtimCnt=0 and if bcst=true. */
/* nextAld(trafficMap, currentAld) */
/* returns index greater than currentAld at which TrafficMap=1. */
/* If no locations before sMaxAld are =1, returns 0. */
newtype TrafficMap Array( Asocld, Bit);
adding operators
mkTim : TrafficMap, Integer, Integer, Asocld, Asocld, Boolean -> Octetstring;
nextAld : TrafficMap, Asocld -> Asocld;
operator mkTim;
fpar trf TrafficMap, dtc Integer, dtp Integer, xlo Asocld,
xhi Asocld, bc Boolean; returns Octetstring; referenced;
operator nextAld;
fpar trf TrafficMap, x Asocld; returns Asocld; referenced;
endnewtype TrafficMap;
/* TIM is a subtype of Octetstring with operators: */
/* bufFrame(tim,Ald) returns true if the TIM info field */
/* (obtained using getElem) is =1 at tim(Ald). */
/* bufBcst(tim) returns true if the TIM info field */
/* indicates buffered broadcast/multicast traffic */
/* dtCount(tim) returns DTIM count value from TIM */
/* dtPeriod(tim) returns DTIM period value from TIM */
newtype TIM inherits Octetstring operators all;
adding operators
bufFrame : TIM, Asocld -> Boolean;
bufBcst : TIM -> Boolean;
dtCount : TIM -> Integer;
dtPeriod : TIM -> Integer;
axioms
for all el in TIM( for all a in Asocld(
bufFrame(el, a) ==
if a < (octetVal(el(2) and 0xFE) * 8) then false
else
if a >= ((octetVal(el(2) and 0xFE)*8) + ((Length(el)-3)*8))
then false
else
Extract!(B_S(el), (a-(octetVal(el(2) and 0xFE)*8)+24)) = 1
fi fi;
bufBcst(el) == (el(2) and 0x01) = 0x01;
dtCount(el) == octetVal(el(0));
dtPeriod(el) == octetVal(el(1)); ));
endnewtype TIM;

```



Operator nextAld

NextAld_1a(1)

```

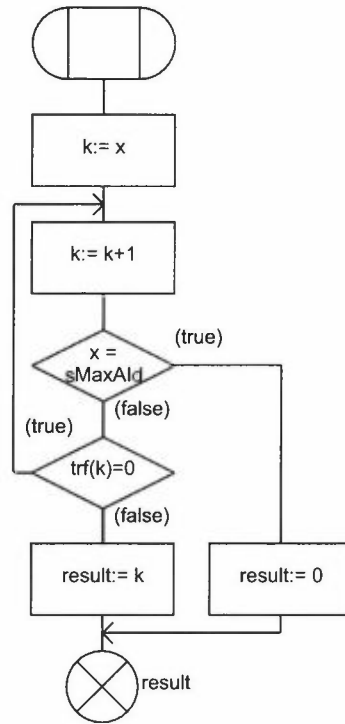
; fpar
;   trf TrafficMap,
;   x AsocId ;
; returns AsocId ;
    
```

```

dcl k, result AsocId ;
    
```

```

/* This procedural operator
is part of sort TrafficMap.
nextAld searches upward
from the specified initial
index (x) in a TrafficMap
and returns the index of
the first bit =1. If the end
of the TrafficMap (index=
sMaxAld) is reached with
no 1s found, a value of 0
is returned. */
    
```





Package macsorts

3125_d\RateAndDurationSorts(31)



```

/*****
 * Multi-rate support sorts
 *****/
newtype Rate inherits Octet operators all;
adding operators
  calcDur : Rate, Integer -> Integer; /* converts (rate,bitCount) to integer usec */
  rateVal : Rate -> Rate; /* clears high-order bit */
  basicRate : Rate -> Rate; /* sets high-order bit */
  isBasic : Rate -> Boolean; /* true if high-order bit set */
axioms
  for all r in Rate( for all i in Integer( for all b in Boolean(
    calcDur(r, i) == (((10000000 + (octetVal(r and 0x7F) - 1)) /
      (500 * octetVal(r and 0x7F))) * i) + 9999) / 10000;
    rateVal(r) == r and 0x7F; basicRate(r) == r or 0x80;
    isBasic(r) == (r and 0x80) = 0x80; ));
endnewtype Rate;
syntype RateString = Octetstring endsyntype RateString;

```

```

/*****
 * MPDU duration factor support sort
 *****/
/* These operators support the encoding used to allow */
/* an Integer to represent the value of aMpduDurationFactor. */
/* calcDF(PlcpBits, MpduBits) returns an Integer which is */
/* the fractional part of ((PlcpBits/MpduBits)-1)*(1e9). */
/* stuff(durFactor, MpduBits) returns the number of PlcpBits */
/* which result from MpduBits at the specified durFactor. */
newtype DurFactor inherits Integer operators all;
adding operators
  calcDF : Integer, Integer -> DurFactor;
  stuff : DurFactor, Integer -> Integer;
axioms
  for all df in DurFactor( for all mb, pb in Integer(
    calcDF(pb, mb) == ((pb * 1000000000) / mb) - 1000000000;
    stuff(df, mb) == ((mb * df) + (mb - 1)) / 1000000000; ));
endnewtype DurFactor;

```




Package macsorts

3126_dFH_DS_Params(31)



```

/*****
 *   FH parameter set sort
 *****/
newtype FhParms inherits Octetstring operators all;
adding operators
  dwellTime : FhParms -> TU; /* Dwell Time field (2) */
  setDwellTime : FhParms, TU -> FhParms;
  hopSet : FhParms -> Integer; /* Hop Set field (1) */
  setHopSet : FhParms, Integer -> FhParms;
  hopPattern : FhParms -> Integer; /* Hop Pattern field (1) */
  setHopPattern : FhParms, Integer -> FhParms;
  hopIndex : FhParms -> Integer; /* Hop Index field (1) */
  setHopIndex : FhParms, Integer -> FhParms;
axioms
  for all fh in FhParms( for all i in Integer( for all u in TU(
    dwellTime(fh) == octetVal(fh(0)) + (octetVal(fh(1)) * 256);
    setDwellTime(fh, u) == mkOS(u mod 256, 1) // mkOS(u / 256, 1) // SubStr(fh, 2, 3);
    hopSet(fh) == octetVal(fh(2));
    setHopSet(fh, i) == SubStr(fh, 0, 2) // mkOS(i, 1) // SubStr(fh, 3, 2);
    hopPattern(fh) == octetVal(fh(3));
    setHopPattern(fh, i) == SubStr(fh, 0, 3) // mkOS(i, 1) // Last(fh);
    hopIndex(fh) == octetVal(fh(4));
    setHopIndex(fh, i) == SubStr(fh, 0, 4) // mkOS(i, 1);));
endnewtype FhParms;

```

```

/*****
 *   DS parameter set sort
 *****/
newtype DsParms inherits Octetstring operators all;
adding operators
  curChannel : DsParms -> Integer; /* Current Channel (1) */
  setCurChannel : DsParms, Integer -> DsParms;
axioms
  for all ds in DsParms( for all i in Integer(
    curChannel(ds) == octetVal(ds(0));
    setCurChannel(ds, i) == mkOS(i); );
endnewtype DsParms;

```



Package macsorts

3127_d\PHY_Params(31)



```

*****
*   Generic PHY parameter set sort
*****/
/* Generic PHY parameter element for signals related to Beacons */
/* and Probe Responses that are PHY-type independent. */
syntype PhyParms = Octetstring  endsyntype PhyParms;

```

```

NEWTYPED PhyChrsts struct
aSlotTime Usec;
aSifsTime Usec;
aCCATime Usec;
aRxTxTurnaroundTime Usec;
aTxPLCPDelay Usec;
aRxPLCPDelay Usec;
aRxTxSwitchTime Usec;
aTxRampOnTime Usec;
aTxRampOffTime Usec;
aTxRFDelay Usec;
aRxRFDelay Usec;
aAirPropagationTime Usec;
aMACProcessingDelay Usec;
aPreambleLength Usec;
aPLCPHeaderLength Usec;
aMPDUDurationFactor DurFactor;
aMPDUMaxLength Integer;
aCWmin Integer;
aCWmax Integer;
EndNewType PhyChrsts;

```

use macsorts ;

Package macmib

3201_d\StationConfig(5)

/* This Package contains definitions of the MAC MIB attributes and the subset of the PHY MIB attributes used by the MAC state machines. These are needed under Z.100 to permit analysis of the state machine definitions. In future revisions these may be replaced with the ASN.1 MIB definition which appears as Annex D, for use with a Z.105-compliant SDL tool is available. */

```

/*
* StationConfig Table
*/
remote dot11MediumOccupancyLimit TU nodelay;
synonym dot11CfPollable Boolean = <<package macsorts>> sCfPollable;
remote dot11CfpPeriod Integer nodelay;
remote dot11CfpMaxDuration TU nodelay;
remote dot11AuthenticationResponseTimeout TU nodelay;
synonym dot11PrivacyOptionImplemented Boolean=true;
remote dot11PowerMangementMode PwrSave nodelay;
remote dot11DesiredSsid OctetString nodelay;
remote dot11DesiredBssType BssType nodelay;
remote dot11OperationalRateSet RateString nodelay;
remote dot11BeaconPeriod TU nodelay;
remote dot11DtimPeriod Integer nodelay;
remote dot11AssociationResponseTimeout TU nodelay;

remote dot11WepUndecryptableCount Counter32 nodelay;
remote dot11ReceiveDTIMs Boolean nodelay;
remote dot11AuthenticationType AuthTypeSet nodelay;

```

```

/*
* AuthenticationAlgorithms Table
*/
synonym dot11AuthenticationAlgorithms AuthTypeSet =
incl(open_system, incl(shared_key));
/* NOTE: The members of this set are the
dot11AuthenticationAlgorithm values of all
dot11 AuthenticationAlgorithmsEntry instances
for which dot11AuthenticationAlgorithmsEnable=True.
Do not include shared_key in this set
unless dot11PrivacyOptionImplemented=true. */

```

```

/*
* WepDefaultKeys Table
* (if dot11PrivacyOptionImplemented=true)
*/
remote dot11WepDefaultKeys KeyVector nodelay;

```

```

/*
* WepKeyMappings Table
* (if dot11PrivacyOptionImplemented=true)
*/
remote dot11WepKeyMappings KeyMapArray nodelay;

```

use macsorts ;

Package macmib

3202_d\PrivOperation(5)

```

/*****
 * Privacy Table
 * (only if dot11PrivacyOptionImplemented=true)
 *****/
remote dot11PrivacyInvoked Boolean nodelay;
remote dot11WepDefaultKeyId KeyIndex nodelay;
synonym dot11WepKeyMappingLength Integer =
  <<package macsorts>> sWepKeyMappingLength;
remote dot11ExcludeUnencrypted Boolean nodelay;
remote dot11WepIcvErrorCount Counter32 nodelay;
remote dot11WepExcludedCount Counter32 nodelay;

```

```

/*****
 * Operation Table
 *****/
synonym dot11MacAddress MacAddr =
  <<type MacAddr>> S6(0x00, 0x11, 0x22, 0x33, 0x44, 0x55);
  /* each station has a unique globally administered address */
  /* Value may be overwritten with locally administered address at */
  /* MlmeReset, but is always a static value during MAC operation */
remote dot11RtsThreshold Integer nodelay;
remote dot11ShortRetryLimit Integer nodelay;
remote dot11LongRetryLimit Integer nodelay;
remote dot11FragmentationThreshold Integer nodelay;
remote dot11MaxTransmitMsduLifetime TU nodelay;
remote dot11MaxReceiveLifetime TU nodelay;
synonym dot11ManufacturerId Charstring = 'name of manufacturer';
synonym dot11ProductId Charstring = 'identifier unique to manufacturer';

```

```

/*****
 * GroupAddresses Table
 *****/
remote dot11GroupAddresses MacAddrSet nodelay;

```

use macsorts ;

Package macmib

3203_d\Counters(5)



```
/*  
* Counters Table  
*/  
remote dot11TransmittedFragmentCount Counter32 nodelay;  
remote dot11MulticastTransmittedFrameCount Counter32 nodelay;  
remote dot11FailedCount Counter32 nodelay;  
remote dot11RetryCount Counter32 nodelay;  
remote dot11MultipleRetryCount Counter32 nodelay;  
remote dot11RtsSuccessCount Counter32 nodelay;  
remote dot11RtsFailureCount Counter32 nodelay;  
remote dot11AckFailureCount Counter32 nodelay;  
remote dot11ReceivedFragmentCount Counter32 nodelay;  
remote dot11MulticastReceivedFrameCount Counter32 nodelay;  
remote dot11FcsErrorCount Counter32 nodelay;  
remote dot11FrameDuplicateCount Counter32 nodelay;
```

use macsorts ;

Package macmib

3204_d\PhyOperation(5)



```

/*****
*   PhyOperation Table
*   (values shown are mostly for FH PHY)
*****/
synonym FHphy Integer = 01; /* enumerated dot11PHYType value */
synonym DSphy Integer = 02; /* enumerated dot11PHYType value */
synonym IRPhy Integer = 03; /* enumerated dot11PHYType value */
synonym dot11PHYType Integer = FHphy;
remote dot11CurrentRegDomain Integer nodelay;
synonym dot11TempType Integer = 01;

/*****
*   PhyCharacteristic Parameters (values shown are mostly for FH PHY )
*****/
/* NOTE: The PhyCharacteristics are defined as synonyms because
their values are static during MAC operation. It is assumed
that , during each initialization of MAC operation, current
values for each of these parameters are obtained from the
PHY using the PlmeCharacteristics primitive. */
synonym aSlotTime Usec = (aCcaTime + aRXTxTurnaroundTime +
aAirPropagationTime + aMacProcessingTime);
synonym aCcaTime Usec = 27;
synonym aRXTxTurnaroundTime Usec = (aTxPlcpDelay + aRXTxSwitchTime +
aTxRampOnTime + aTxRfDelay);
synonym aTxPlcpDelay Usec = 1;
synonym aRXTxSwitchTime Usec = 10;
synonym aTxRampOnTime Usec = 8;
synonym aTxRfDelay Usec = 1;
synonym aSifsTime Usec = (aRxRfDelay + aRxPlcpDelay +
aMacProcessingTime + aRXTxTurnaroundTime);
synonym aRxRfDelay Usec = 4;
synonym aRxPlcpDelay Usec = 2;
synonym aMacProcessingTime Usec = 2;
synonym aTxRampOffTime Usec = 8;
synonym aPreambleLength Usec = 96;
synonym aPlcpHeaderLength Usec = 32;
synonym aMpduDurationFactor <<package macsorts>> DurFactor = 31250000;
synonym aMpduMaxLength Integer = 4095;
synonym aAirPropagationTime Usec = 1;
synonym aCWmax Integer = 1023;
synonym aCWmin Integer = 15;

```

use macsorts ;

Package macmib

3205_d\PhyRateFhss(5)



```

/*****
 * SupportedDataRatesTx Table (values shown are for FH PHY)
 *****/
synonym aSupportedRatesTx Octetstring = S8(0x82, 0x04, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00);

/*****
 * SupportedDataRatesRx Table (values shown are for FH PHY)
 *****/
synonym aSupportedRatesRx Octetstring = S8(0x82, 0x04, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00);

synonym aPrefMaxMpduFragmentLength Integer = aMpduMaxLength;
    
```

```

/*****
 * PhyFHSS Table
 * (only used with FH PHY)
 *****/
synonym dot11HopTime Usec = 224;
remote dot11CurrentChannelNumber Integer nodelay;
synonym dot11MaxDwellTime TU = 390;
remote dot11CurrentSet Integer nodelay;
remote dot11CurrentPattern Integer nodelay;
remote dot11CurrentIndex Integer nodelay;
    
```

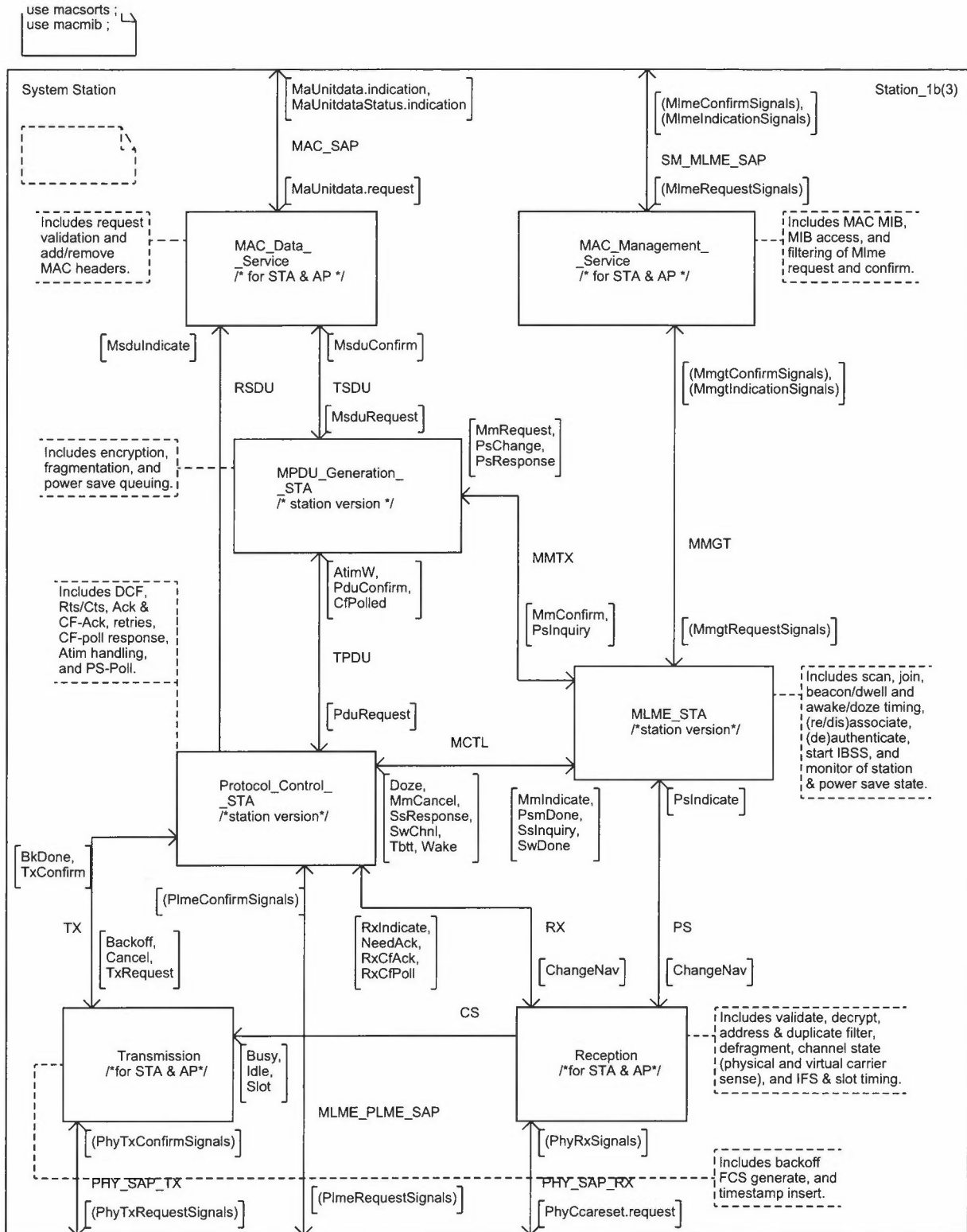
```

/*****
/* The MAC state machines currently do not reference any attributes in:
   PhyAntenna Table, PhyTxPower Table, PhyDsss Table, PhyIrr Table,
   RegDomainsSupported Table, AntennasList Table. */
/*endpackage;*/
/*****
    
```

C.3 State machines for MAC stations

The following SDL-92 system specification defines operation of the MAC protocol at an IEEE 802.11 STA. Many aspects of STA operation also apply to AP operation. These are defined in blocks and processes referenced from both the STA and AP system specifications. Blocks and processes used in both STA and AP are identifiable by the SDL comment `/* for STA & AP */` below the block or process name. Blocks and processes specific to STA operation are identifiable by the SDL comment `/* station version */` below the block or process name. The definitions of all blocks and processes referenced in the station system specification appear in Clause C.3.

The remainder of Clause C.3 is the formal description, in SDL/GR, of an IEEE 802.11 STA.



```
use macsorts ;
use macmib ;
```

System Station

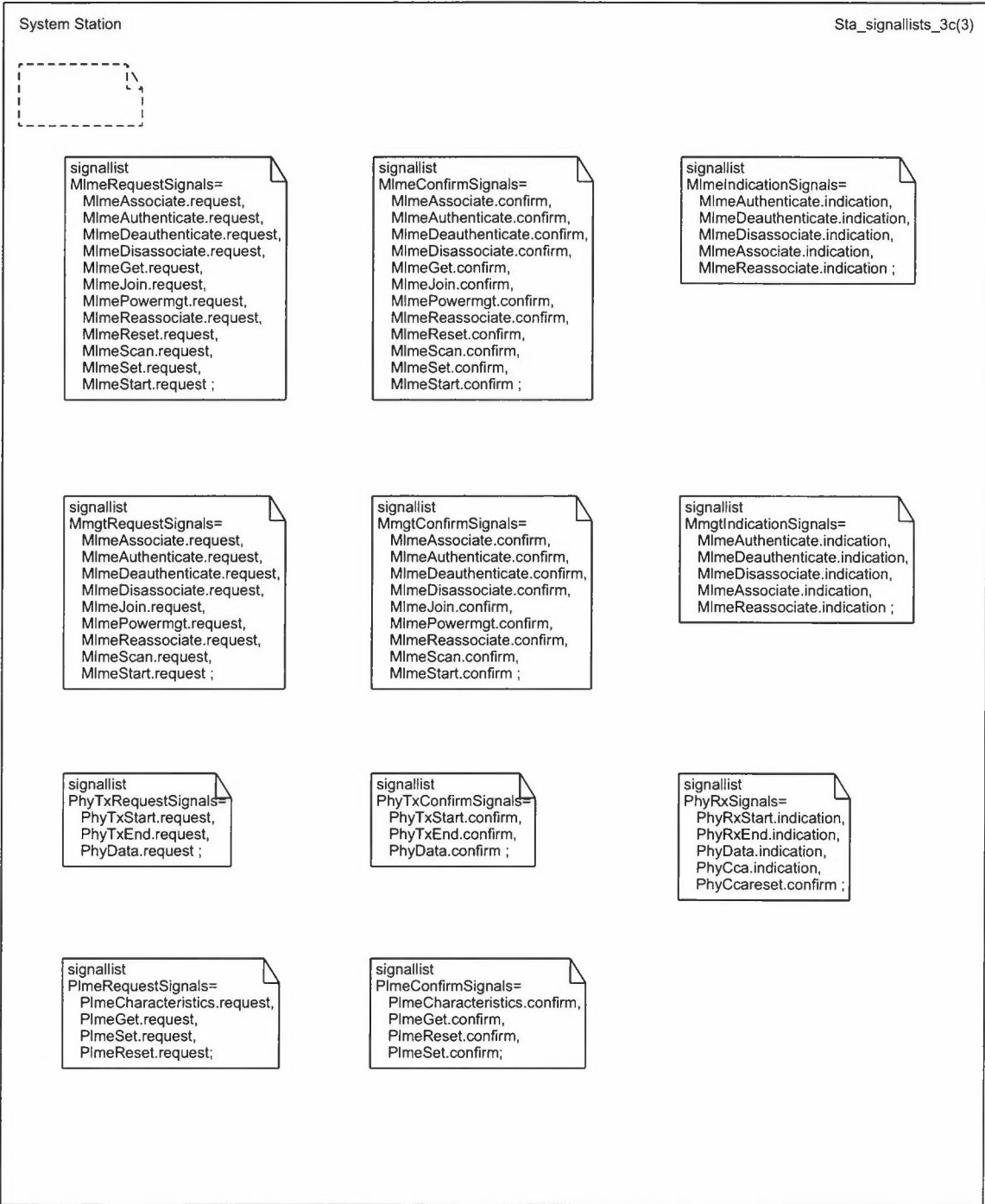
Sta_signals_2d(3)

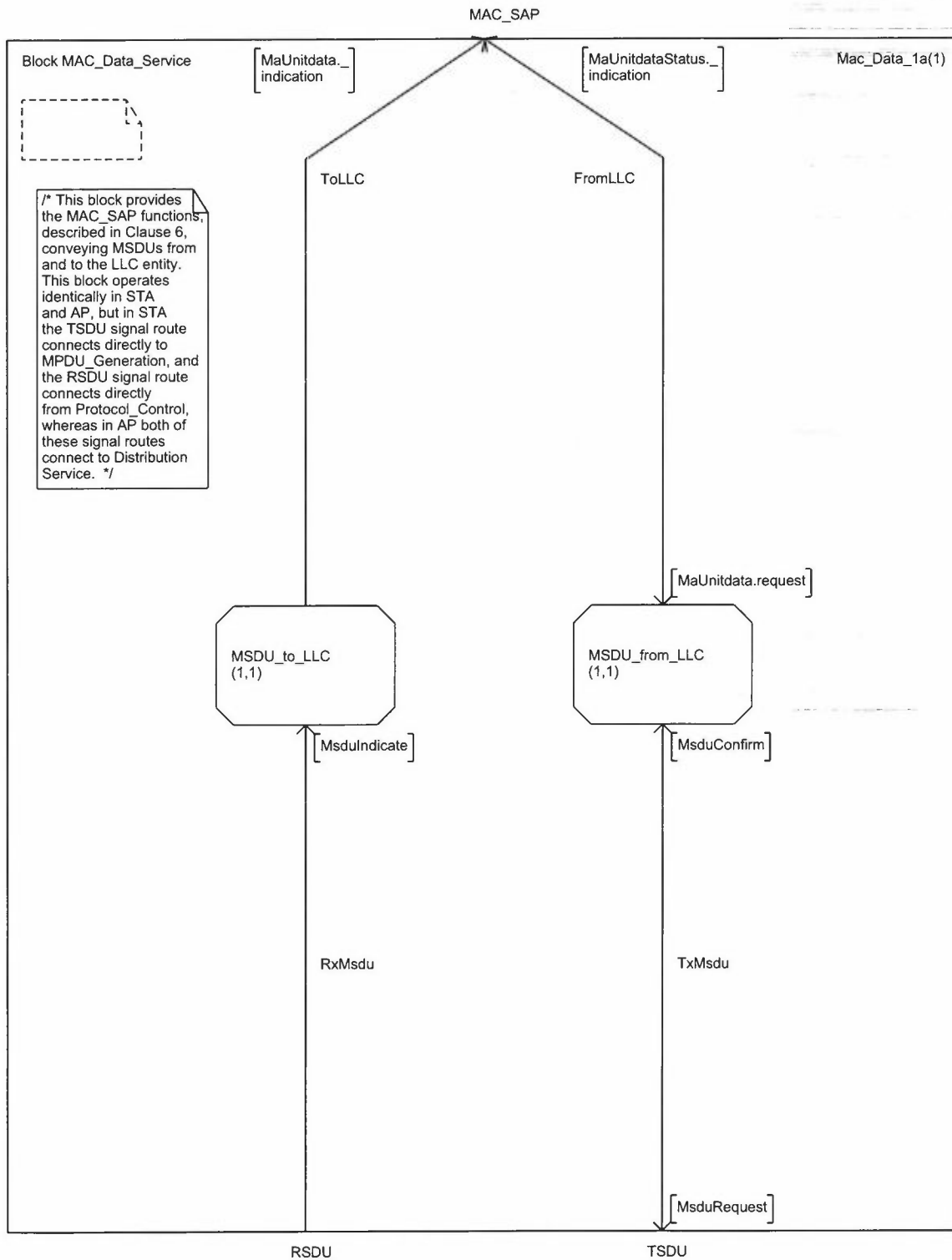


```
signal
  AtimW,
  Backoff(Integer,Integer),
  BkDone(Integer),
  Busy,
  Cancel,
  CfPolled,
  ChangeNav(Time,Duration,NavSrc),
  Doze,
  Idle,
  MaUnitdata.indication(MacAddr,MacAddr,
    Routing,Octetstring,RxStatus,
    CfPriority,ServiceClass),
  MaUnitdata.request(MacAddr,MacAddr,
    Routing,Octetstring,CfPriority,ServiceClass),
  MaUnitdataStatus.indication(MacAddr,
    MacAddr,TxStatus,CfPriority,ServiceClass),
  MimeAssociate.confirm(MimeStatus),
  MimeAssociate.indication(MacAddr),
  MimeAssociate.request(MacAddr,Kusec,Capability,Integer),
  MimeAuthenticate.confirm
    (MacAddr,AuthType,MimeStatus),
  MimeAuthenticate.indication(MacAddr,AuthType),
  MimeAuthenticate.request(MacAddr,AuthType,Kusec),
  MimeDeauthenticate.confirm(MacAddr,MimeStatus),
  MimeDeauthenticate.indication(MacAddr,ReasonCode),
  MimeDeauthenticate.request(MacAddr,ReasonCode),
  MimeDisassociate.confirm(MimeStatus),
  MimeDisassociate.indication(MacAddr,ReasonCode),
  MimeDisassociate.request(MacAddr,ReasonCode),
  MimeGet.confirm(MibStatus,MibAtrib,MibValue),
  MimeGet.request(MibAtrib),
  MimeJoin.confirm(MimeStatus),
  MimeJoin.request(BssDscr,Integer,Usec,Ratestring),
  MimePowermgt.confirm(MimeStatus),
  MimePowermgt.request(PwrSave,Boolean,Boolean),
  MimeReassociate.confirm(MimeStatus),
  MimeReassociate.indication(MacAddr),
  MimeReassociate.request(MacAddr,Kusec,Capability,Integer),
  MimeReset.confirm(MimeStatus),
  MimeReset.request(MacAddr,Boolean),
  MimeScan.confirm(BssDscrSet,MimeStatus),
  MimeScan.request(BssTypeSet,MacAddr,Octetstring,
    ScanType,Usec,Intstring,Kusec,Kusec),
  MimeSet.confirm(MibStatus,MibAtrib),
  MimeSet.request(MibAtrib,MibValue),
  MimeStart.confirm(MimeStatus),
  MimeStart.request(Octetstring,BssType,Kusec,
    Integer,CfParms,PhyParms,IbssParms,Usec,
    Capability,Ratestring,Ratestring) ;
```

```
signal
  MmCancel,
  MmConfirm(Frame,TxStatus),
  MmIndicate(Frame,Time,Time,StateErr),
  MmRequest(Frame,Imed,Rate),
  MsduConfirm(Frame,CfPriority,TxStatus),
  MsduIndicate(Frame,CfPriority),
  MsduRequest(Frame,CfPriority),
  NeedAck(MacAddr,Time,Duration,Rate),
  PduConfirm(FragSdu,TxResult),
  PduRequest(FragSdu),
  PhyCca.indication(Ccstatus),
  PhyCcarst.confirm,
  PhyCcarst.request,
  PhyData.confirm,
  PhyData.indication(Octet),
  PhyData.request(Octet),
  PhyRxEnd.indication(PhyRxStat),
  PhyRxStart.indication(Integer,Rate),
  PhyTxEnd.confirm,
  PhyTxEnd.request,
  PhyTxStart.confirm,
  PhyTxStart.request(Integer,Rate),
  PlmeCharacteristics.confirm(PhyChrctcs),
  PlmeCharacteristics.request,
  PlmeGet.confirm(MibStatus,
    MibAtrib,MibValue),
  PlmeGet.request(MibAtrib),
  PlmeReset.confirm(Boolean),
  PlmeReset.request,
  PlmeSet.confirm(MibStatus,MibAtrib),
  PlmeSet.request(MibAtrib,MibValue),
  PsmDone,
  PsChange(MacAddr,PsMode),
  PsIndicate(MacAddr,PsMode),
  PsInquiry(MacAddr),
  PsResponse(MacAddr,PsMode),
  ResetMAC,
  RxCfAck(MacAddr),
  RxIndicate(Frame,Time,Time,Rate),
  Slot,
  SsInquiry(MacAddr),
  SsResponse(MacAddr,
    StationState,StationState),
  SwChnl(Integer,Boolean),
  SwDone,
  TBTT,
  TxConfirm,
  TxRequest(Frame,Rate),
  Wake ;
```

```
use macsorts ;
use macmib ;
```





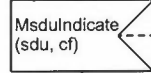
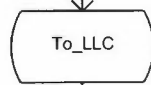
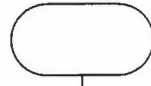
Process MSDU_to_LLC

Msd_u_to_LLC_1a(1)

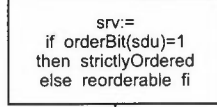
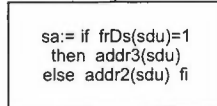
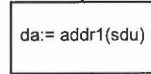


```
dcl cf CfPriority ;
dcl LLCdata Octetstring ;
dcl sa, da MacAddr ;
dcl sdu Frame ;
dcl srv ServiceClass ;
```

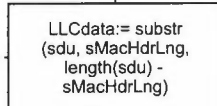
/* This process runs when reception is successfully completed on an MSDU addressed to the local LLC entity. This process extracts the appropriate address and status info, removes the MAC header from the MSDU data field (the FCS and IV/ICV are removed much earlier in reception handling), and generates the indication to LLC. Reception status is always "successful" because a receive error causes the MSDU to be discarded before reaching MAC Data Service. */



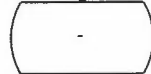
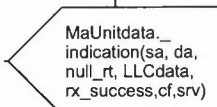
From source of the RSDU channel.
STA source is Protocol Control,
AP source is Distribution Service.

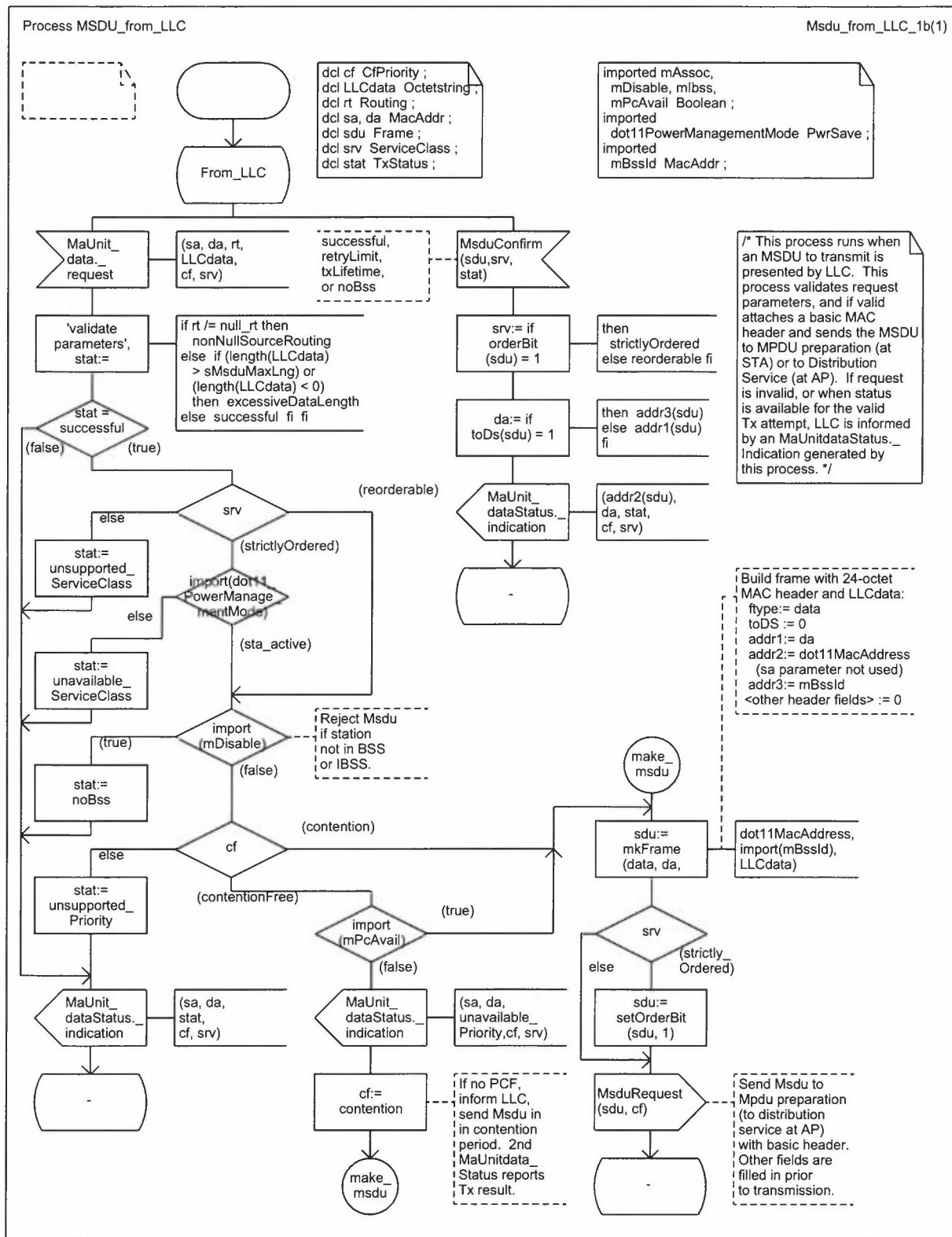


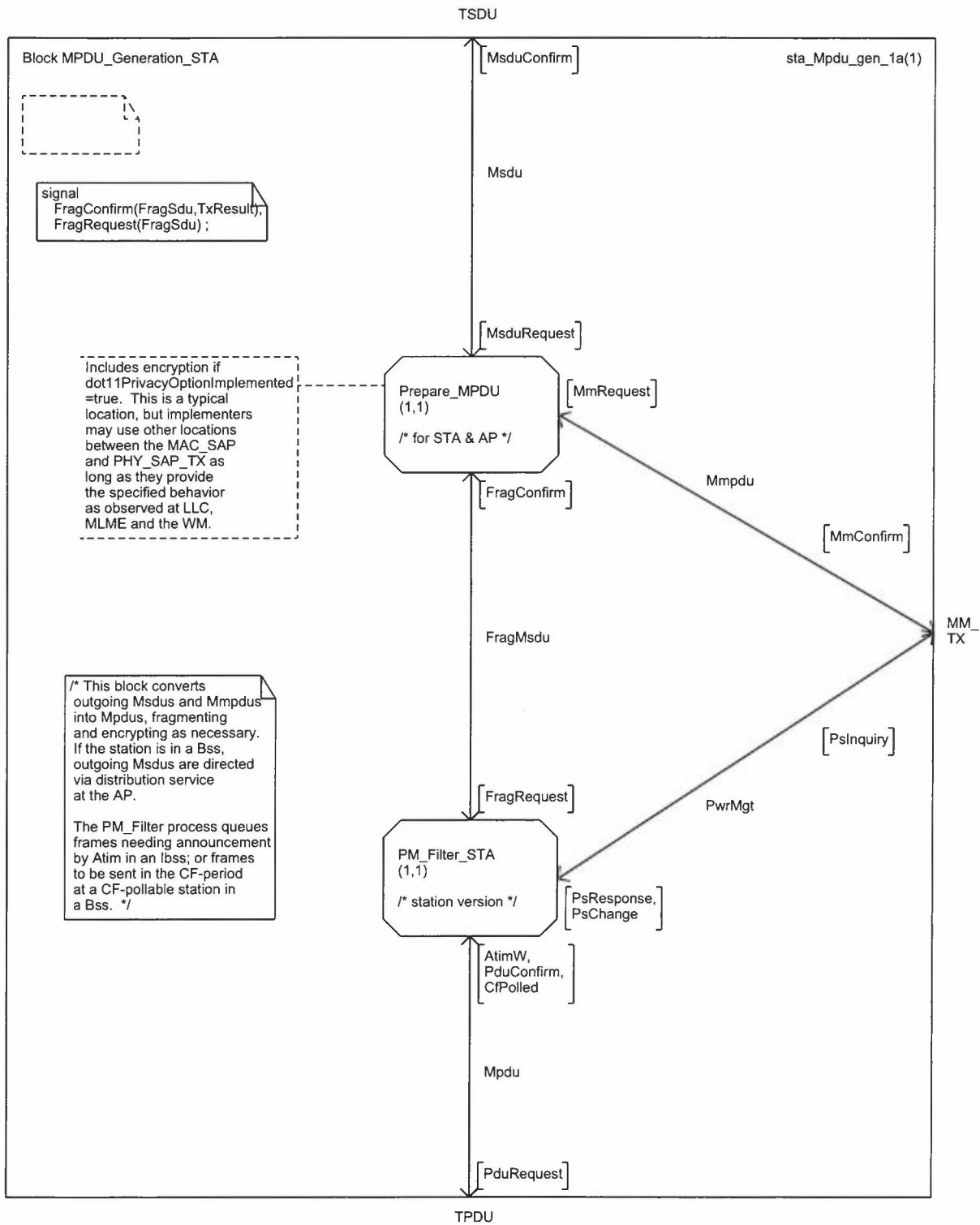
Remove MAC header from beginning of MSDU to obtain the LLC data octet string.

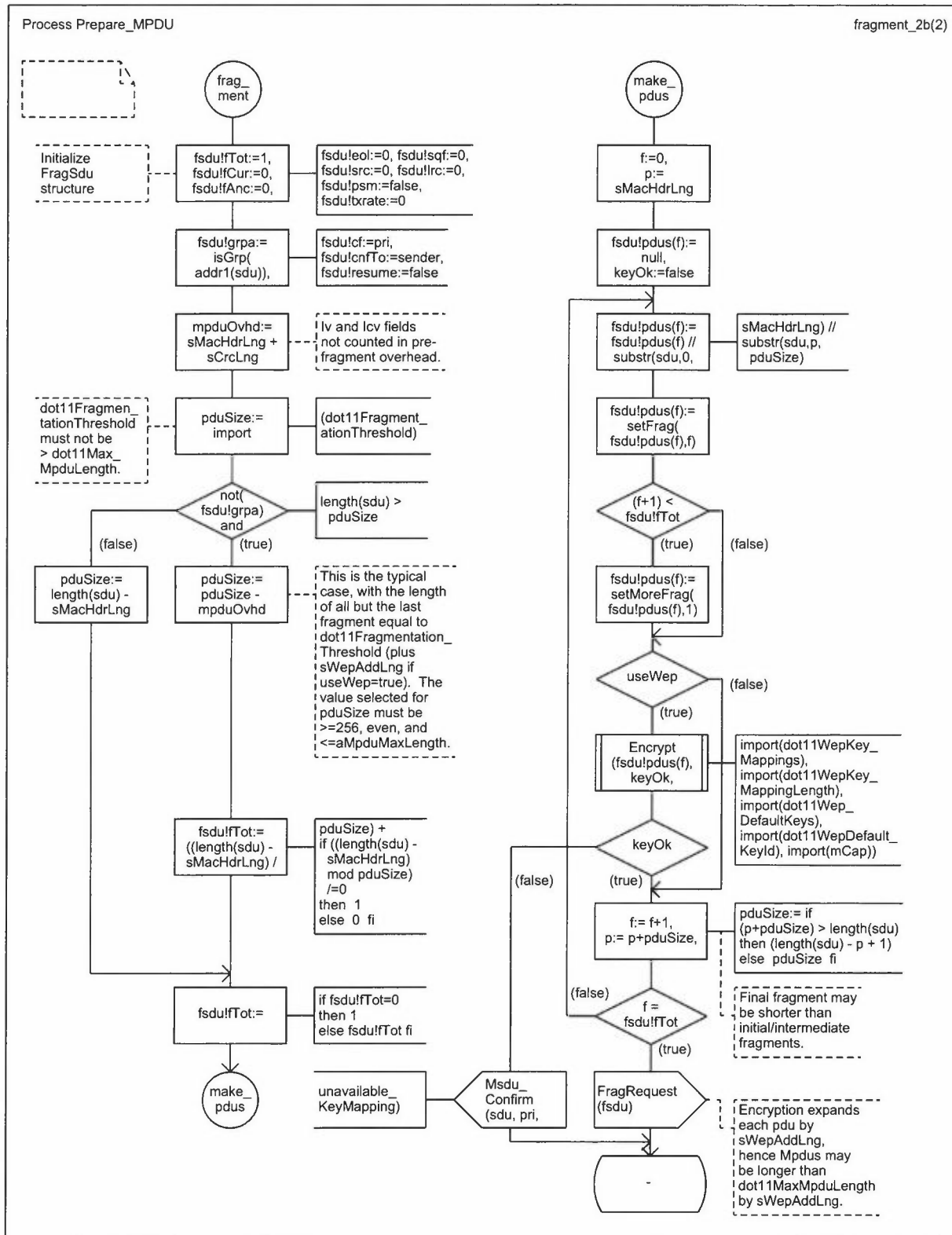


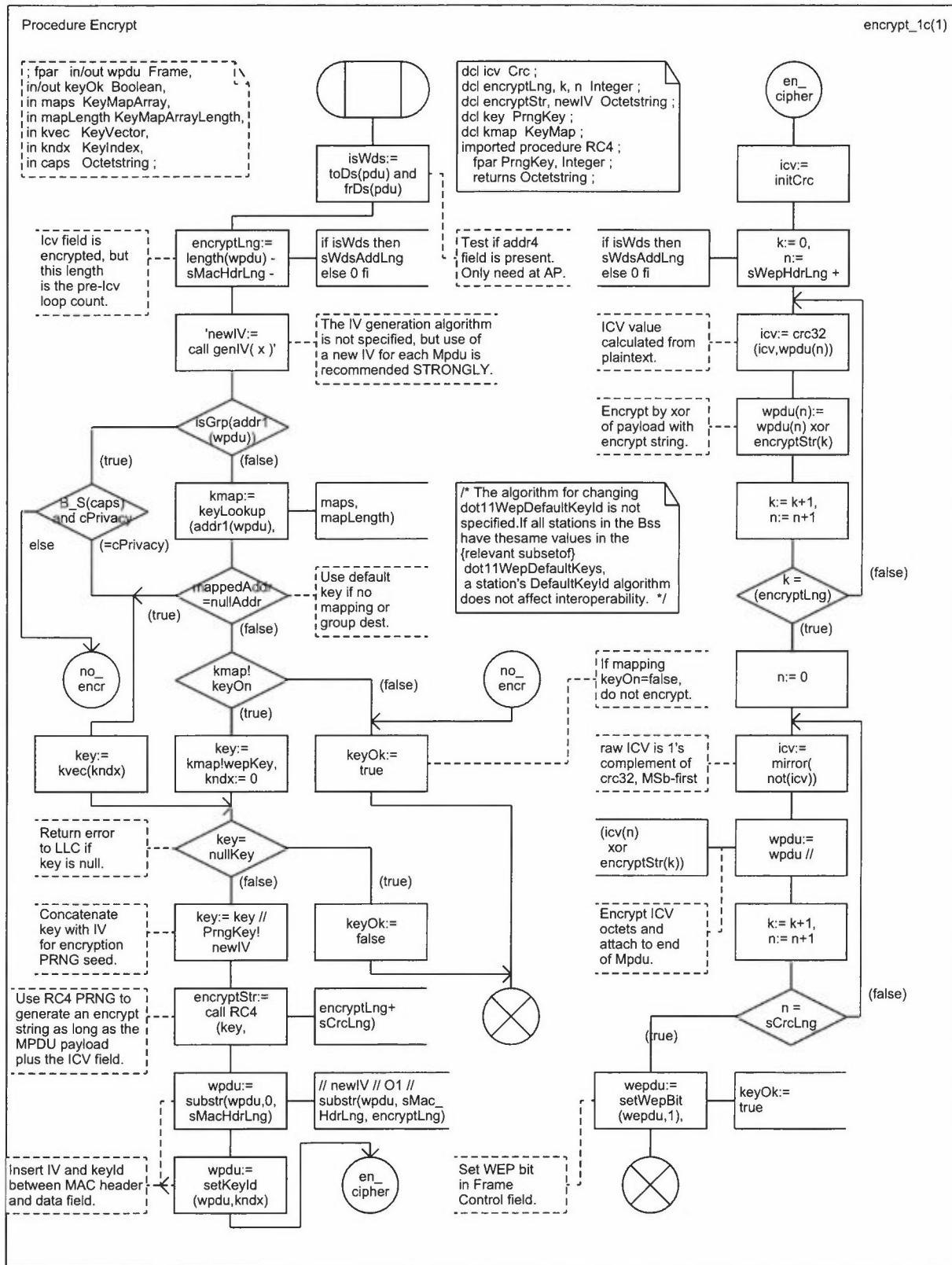
Reception status always successful because any error would prevent the Msdulndicate from reaching this process.

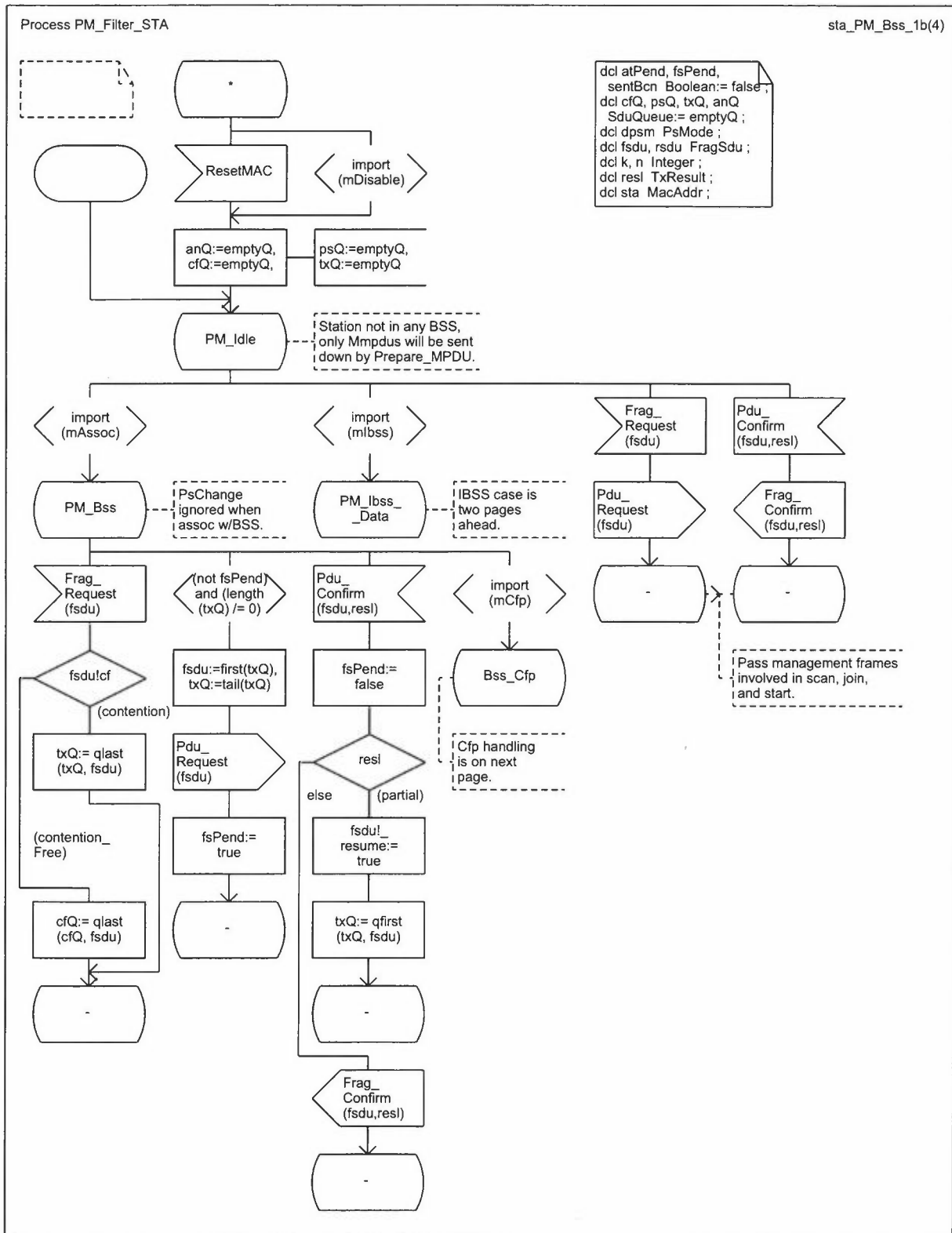


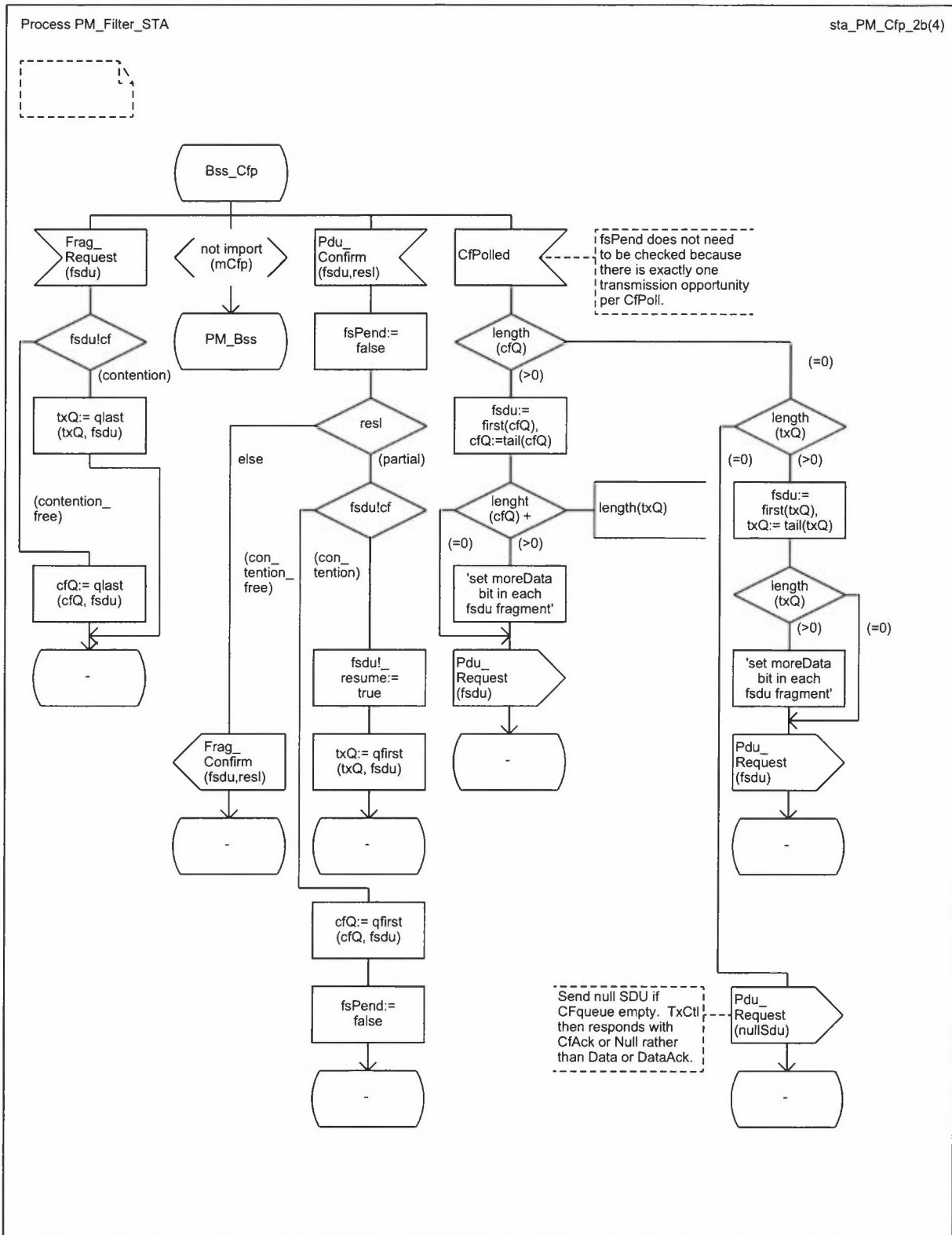


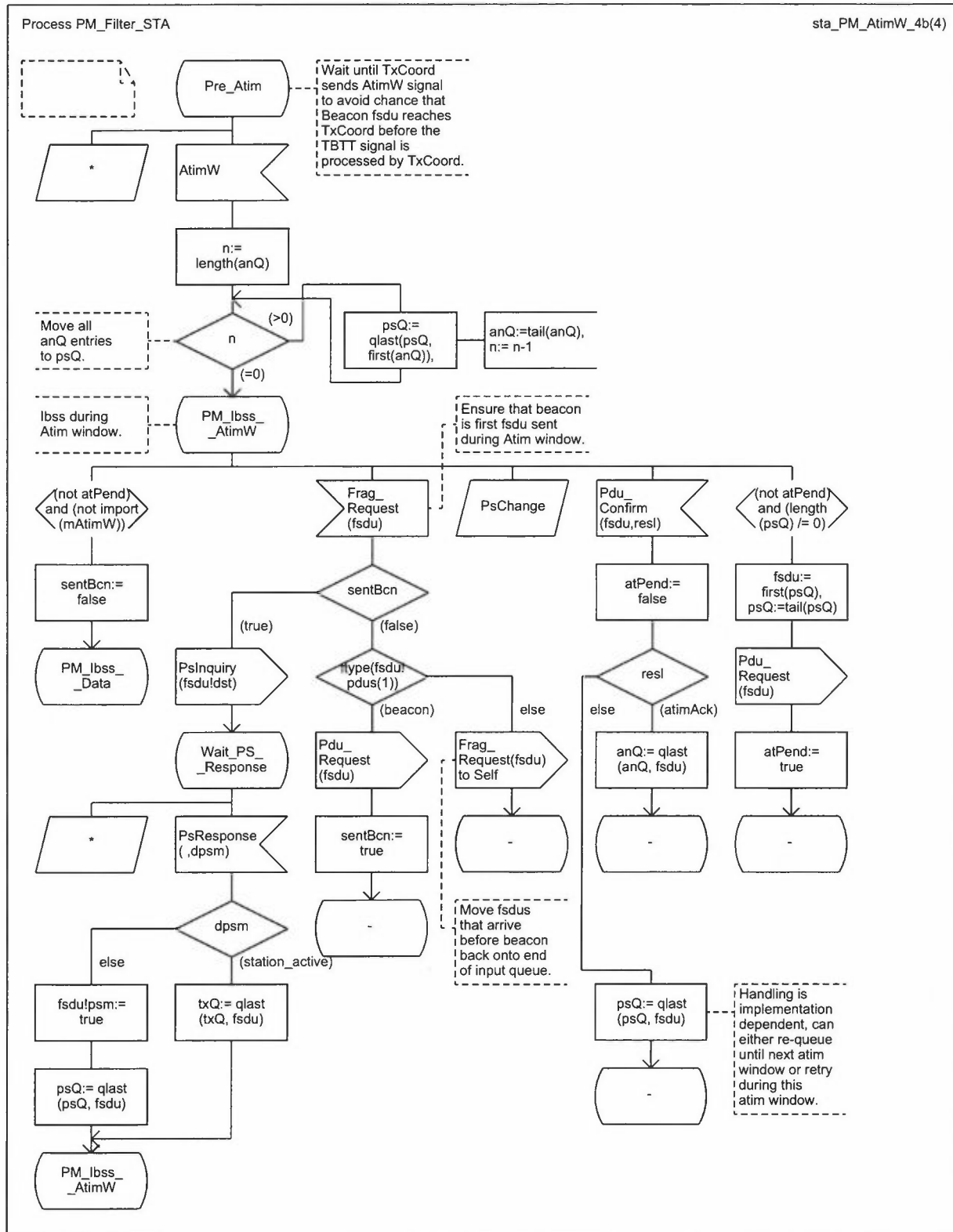


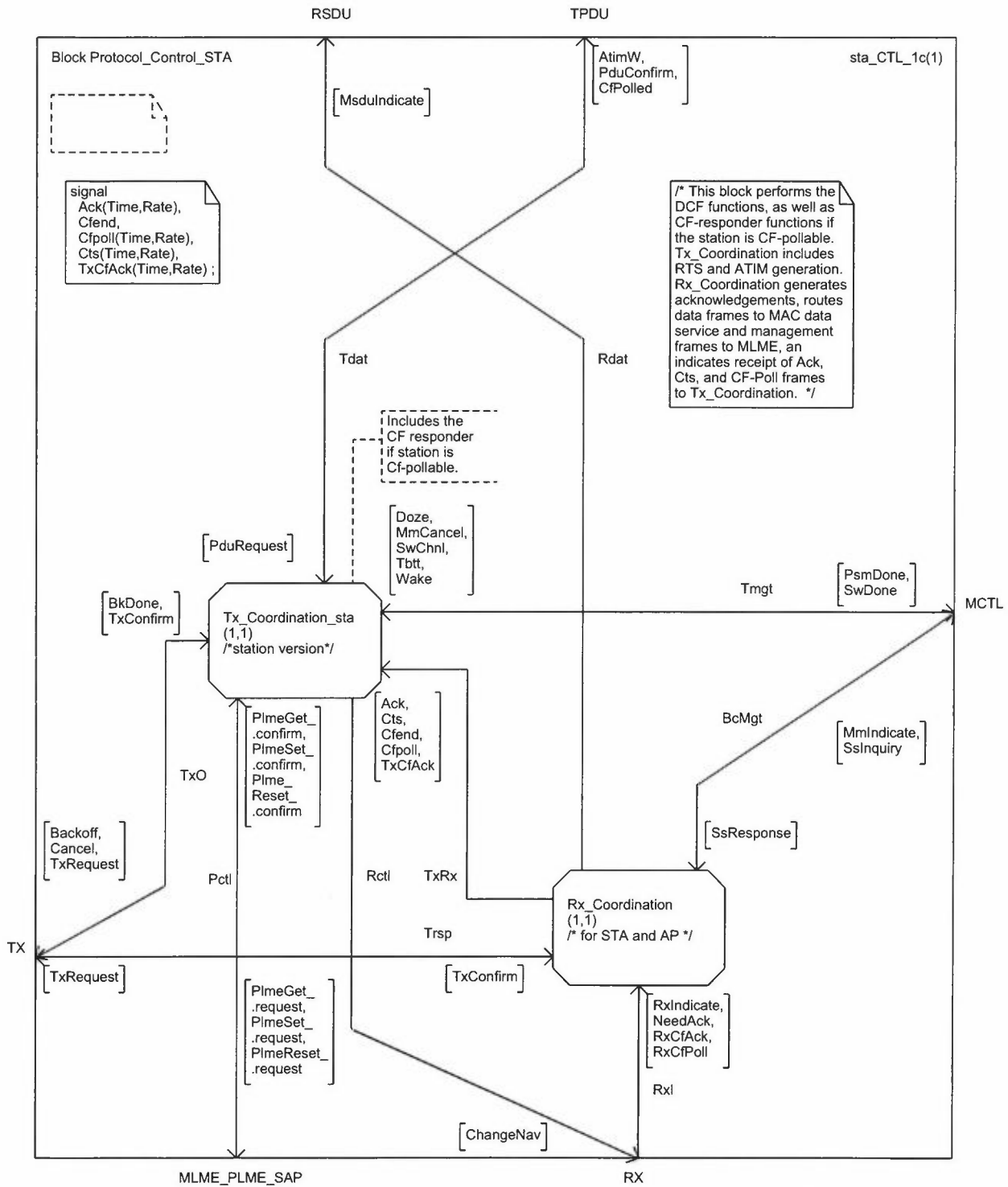


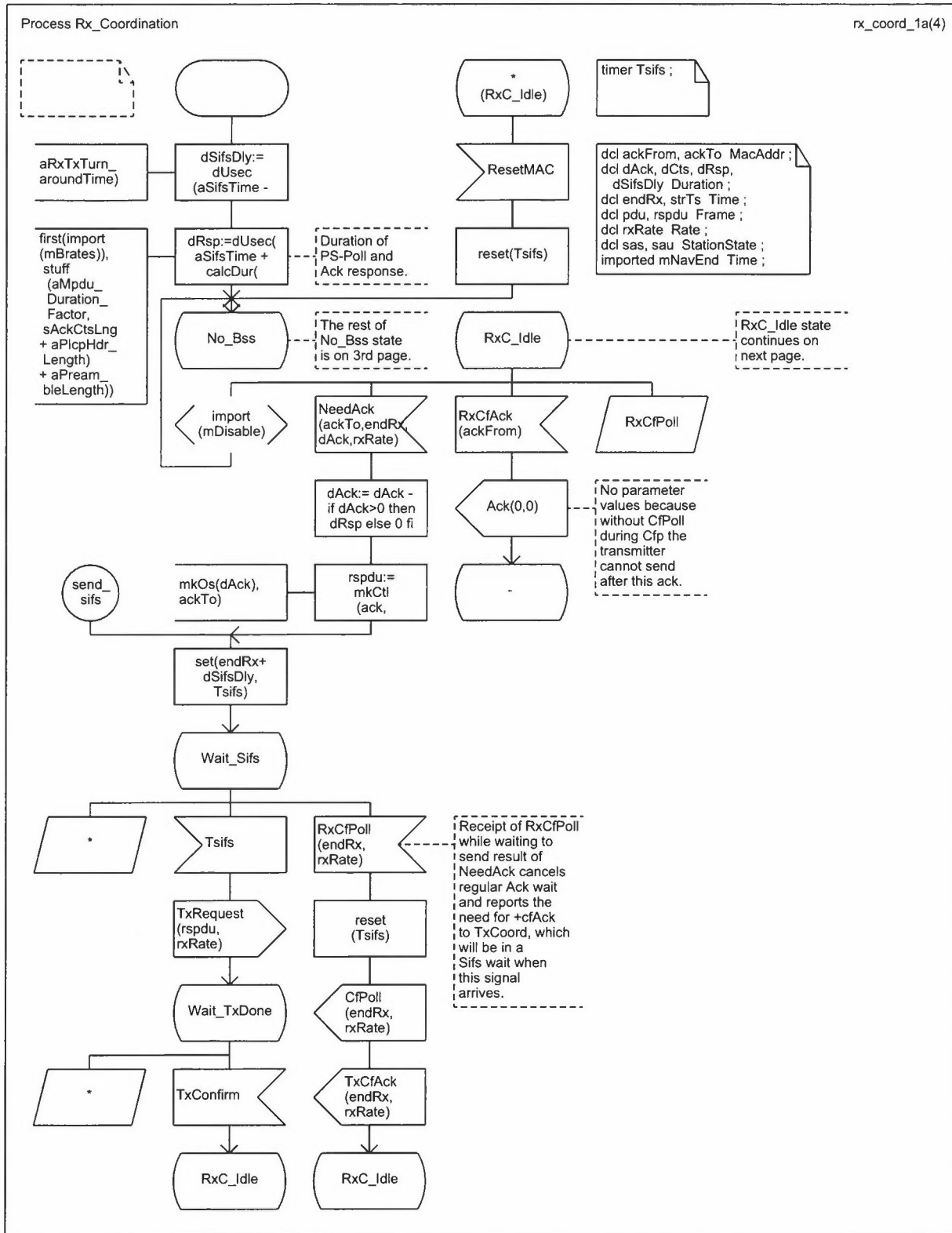






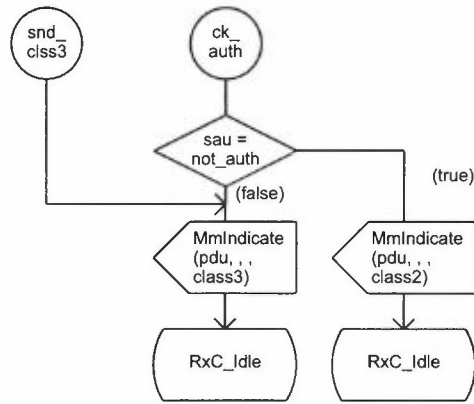


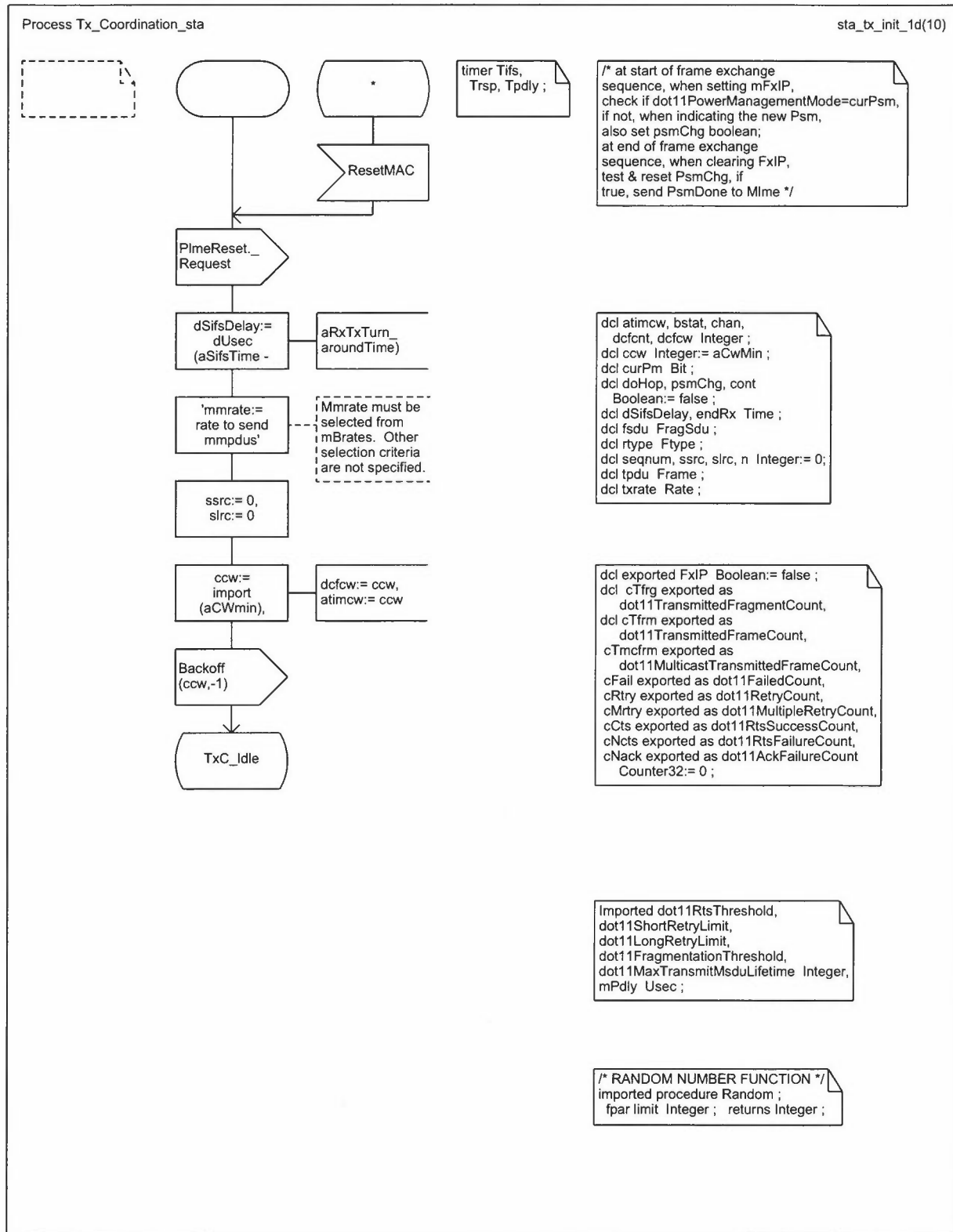


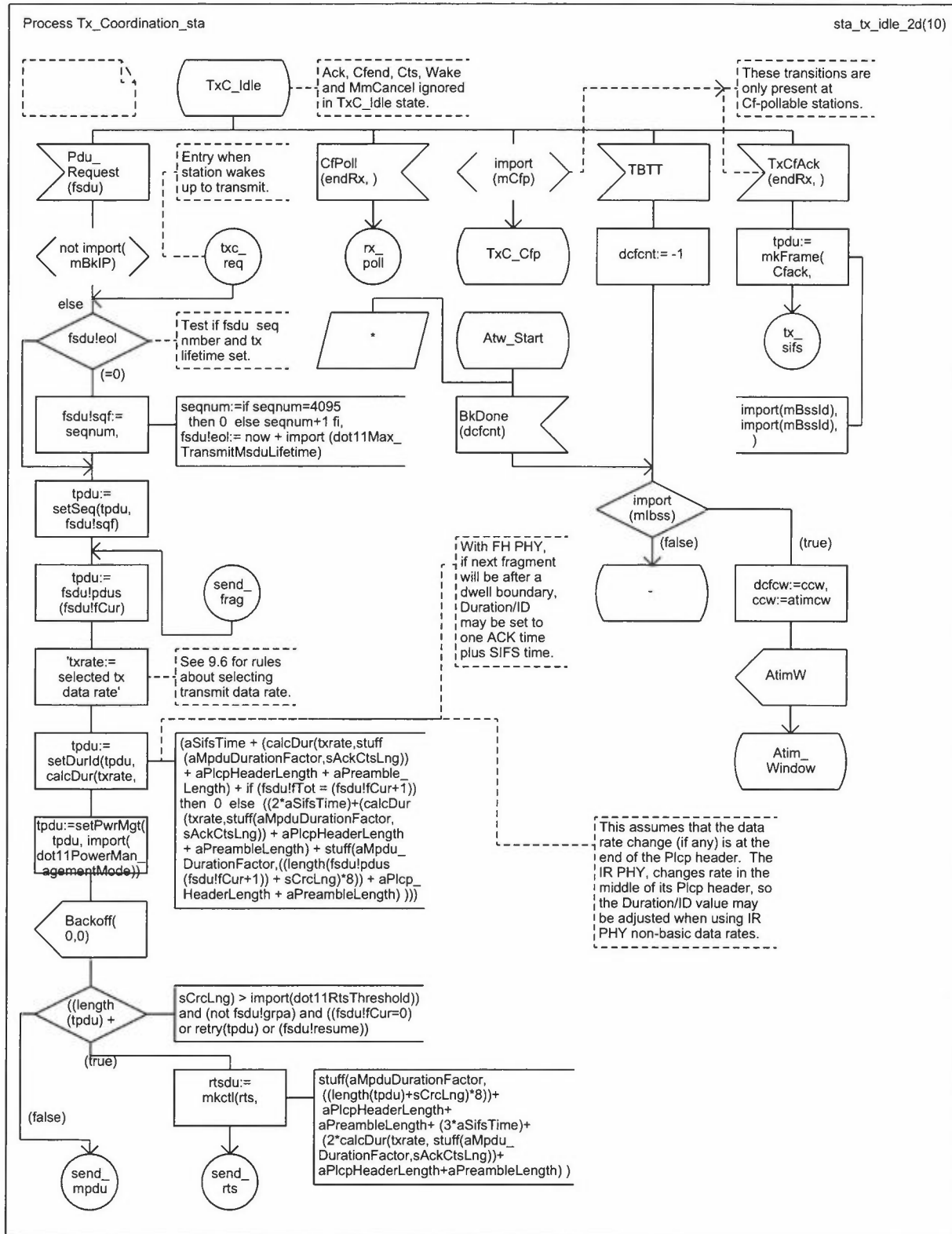


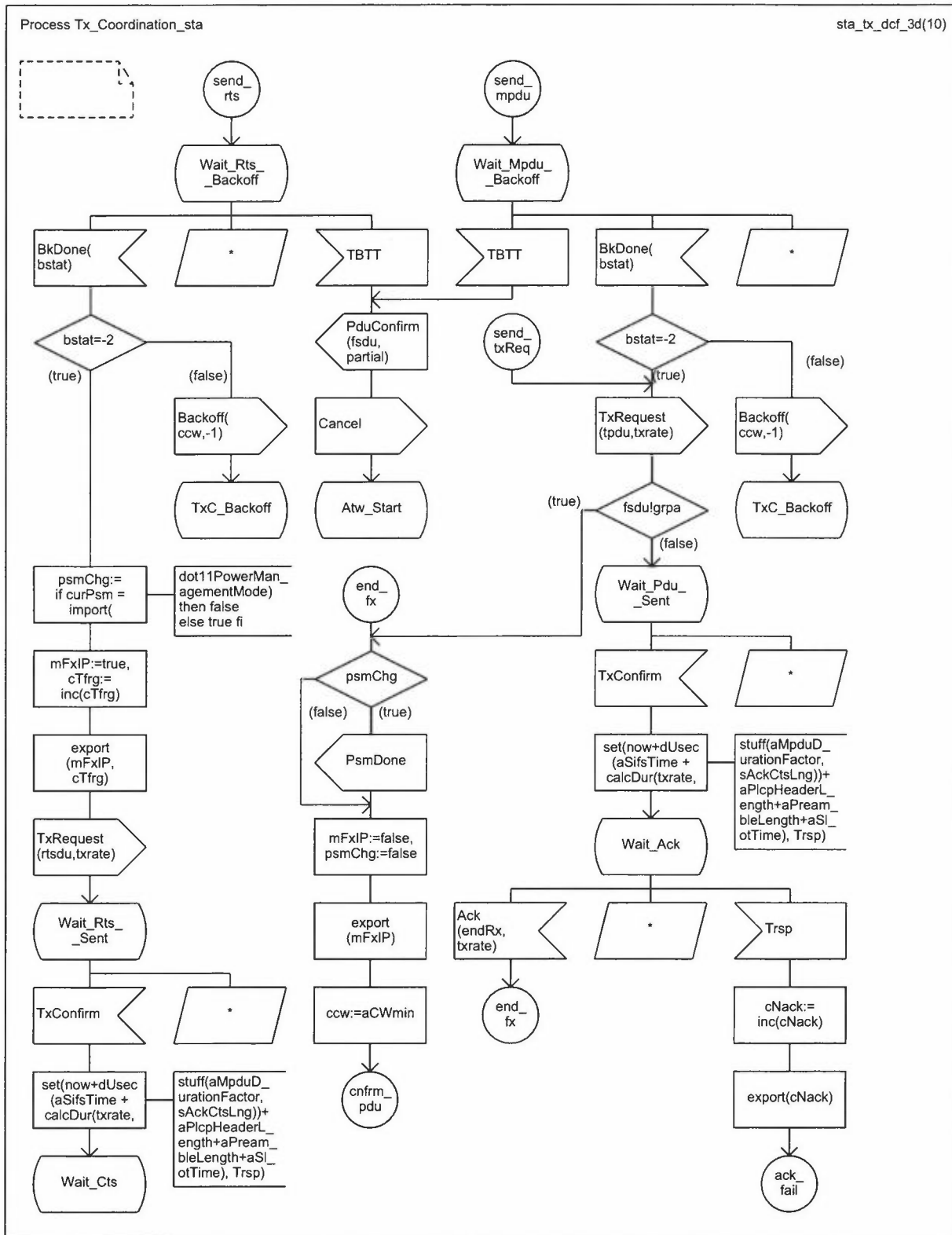
Process Rx_Coordination

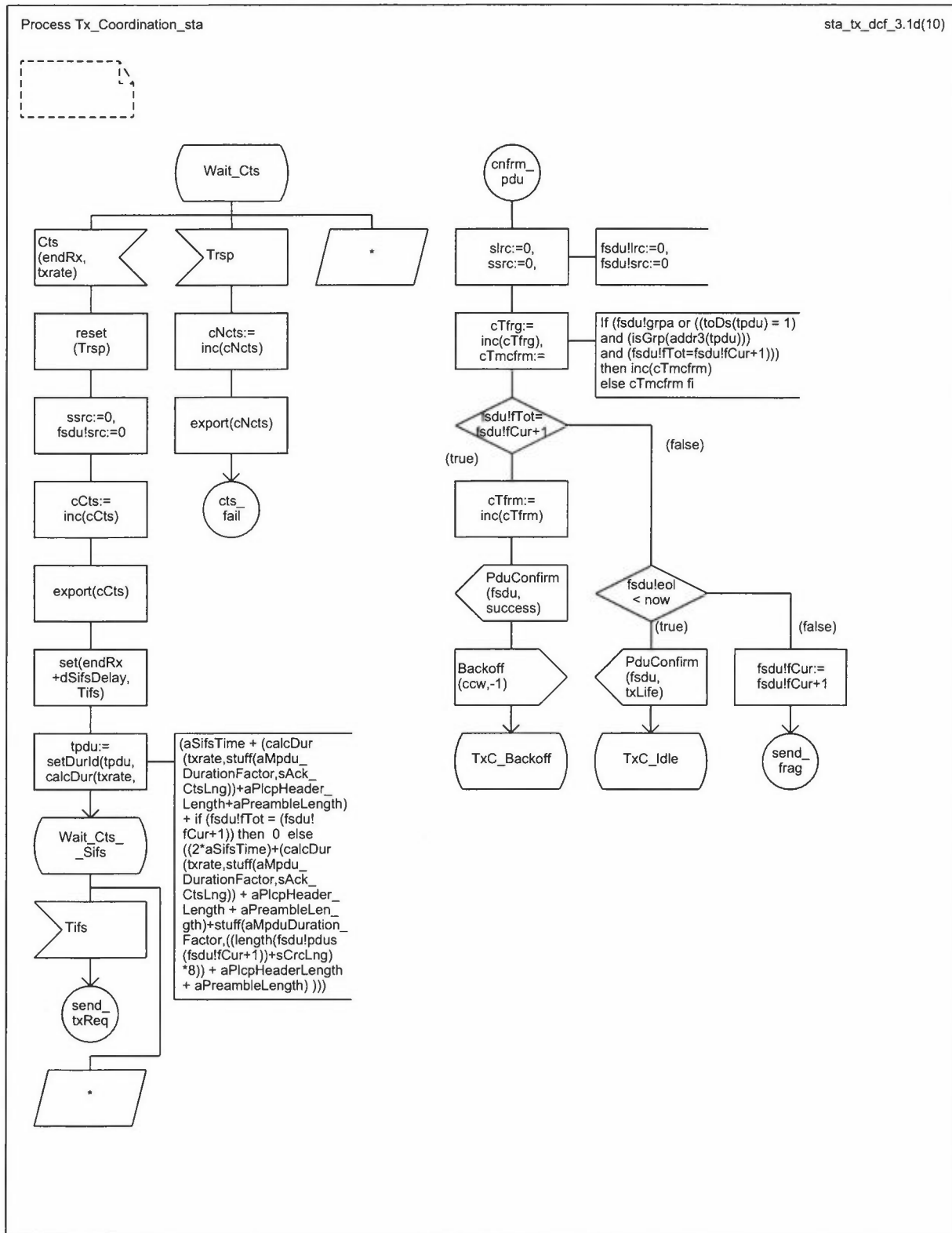
rx_coord_3.1a(4)

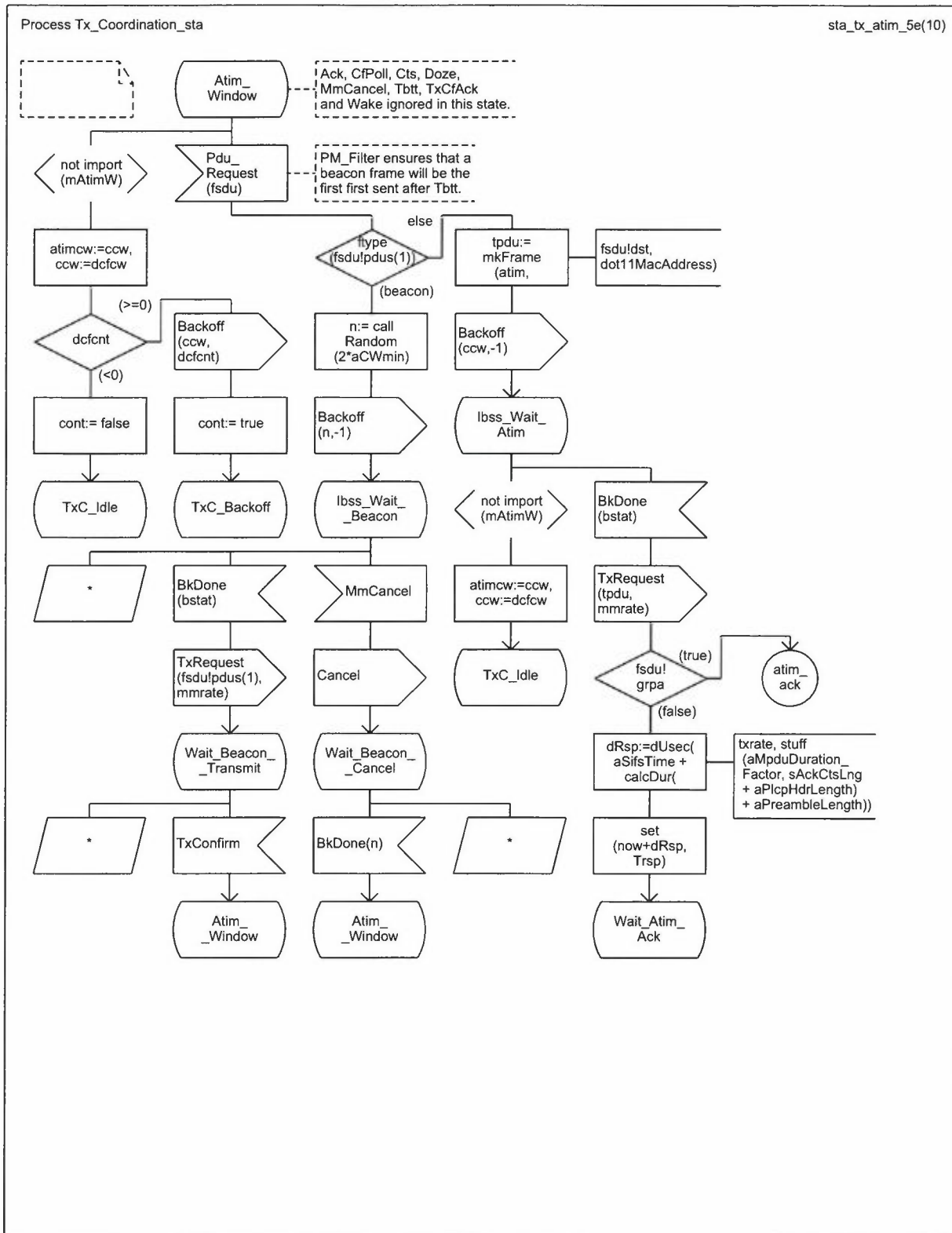


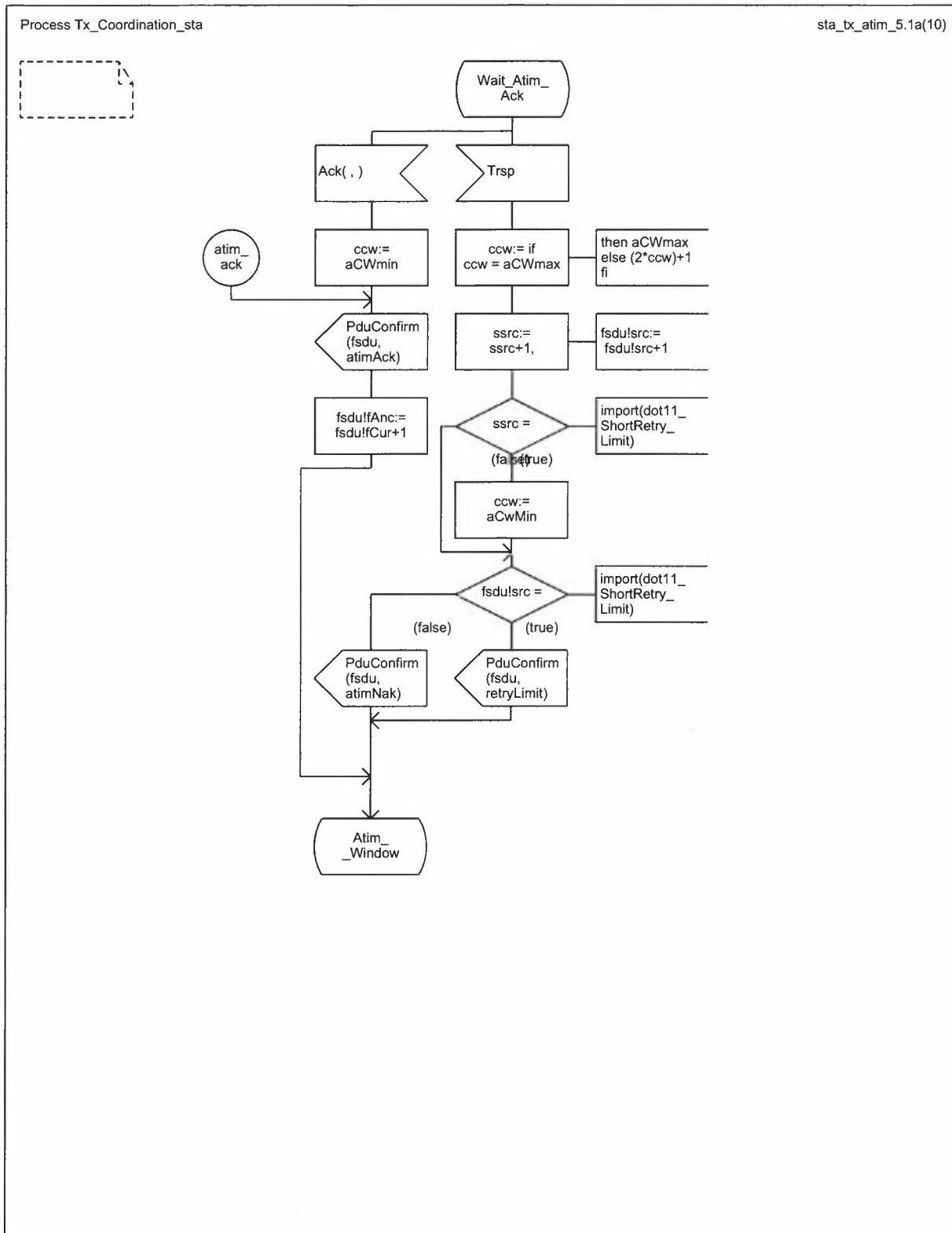


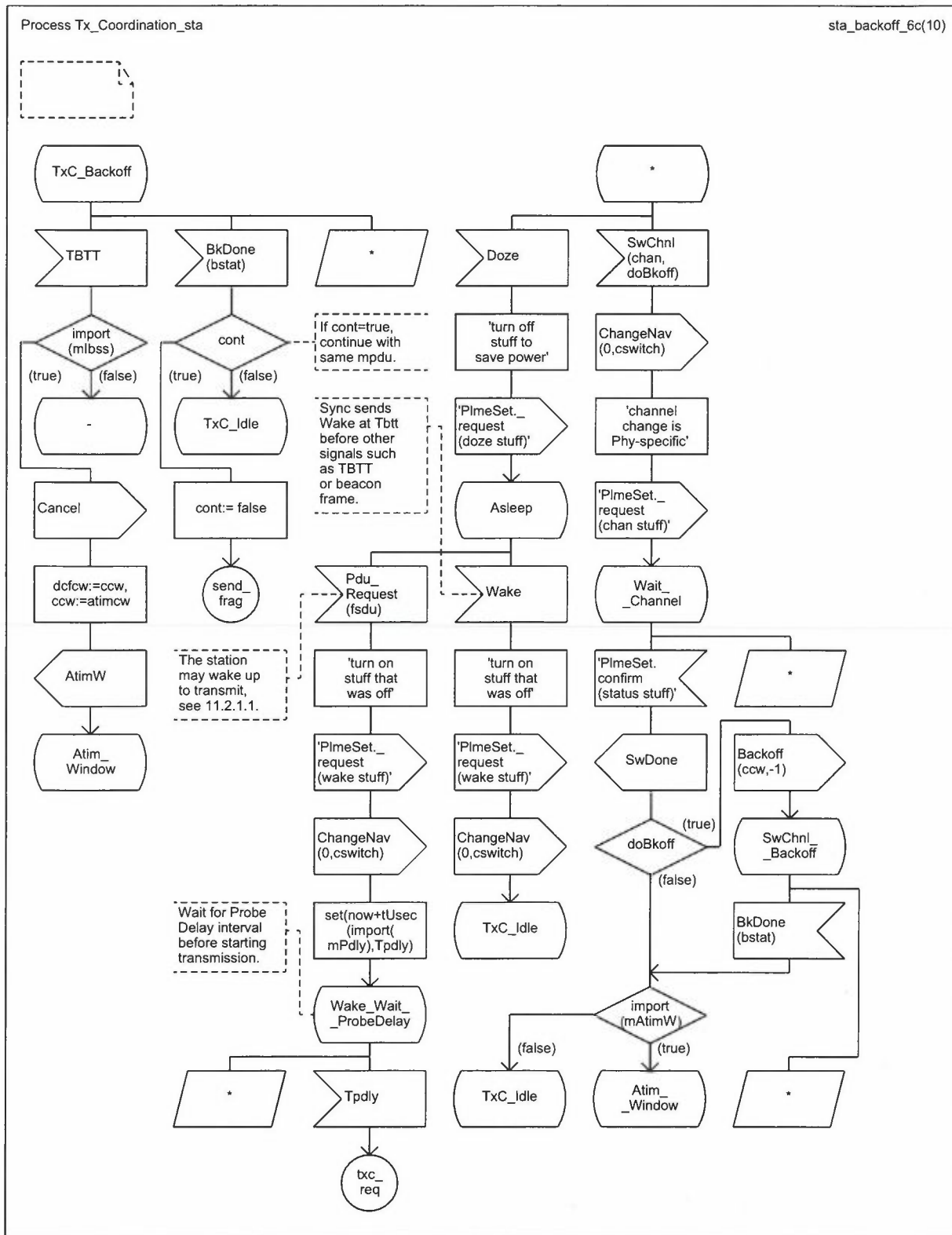


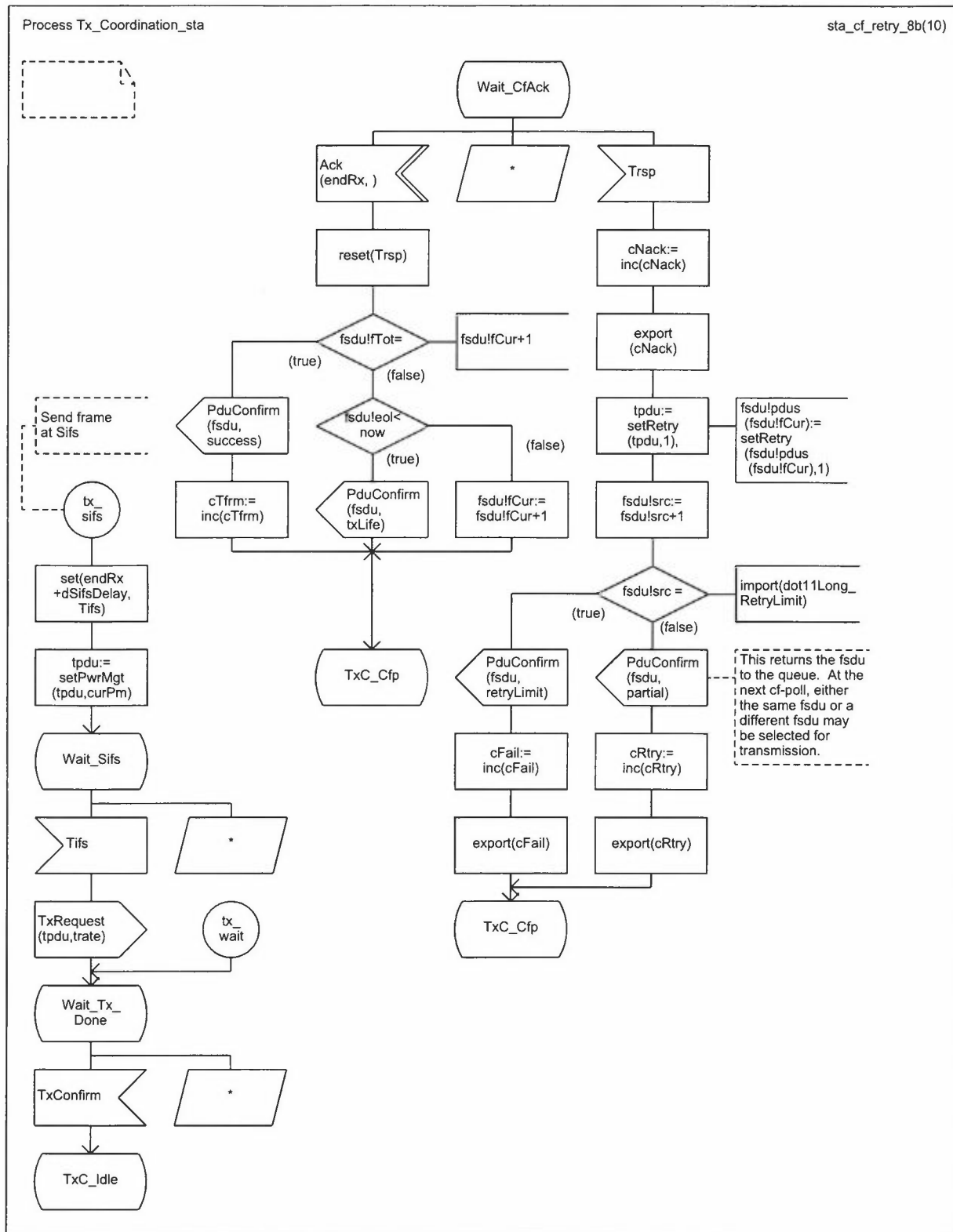


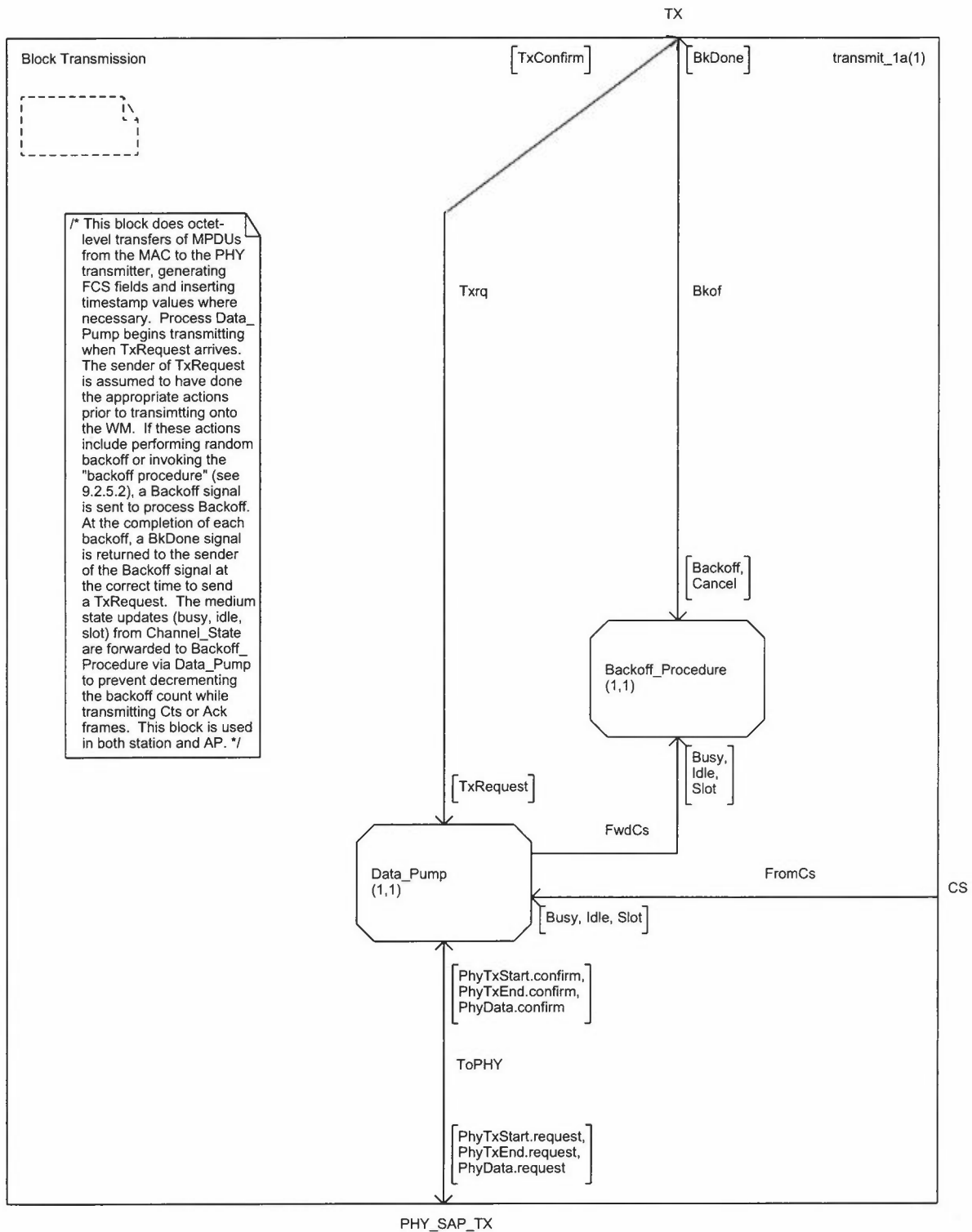


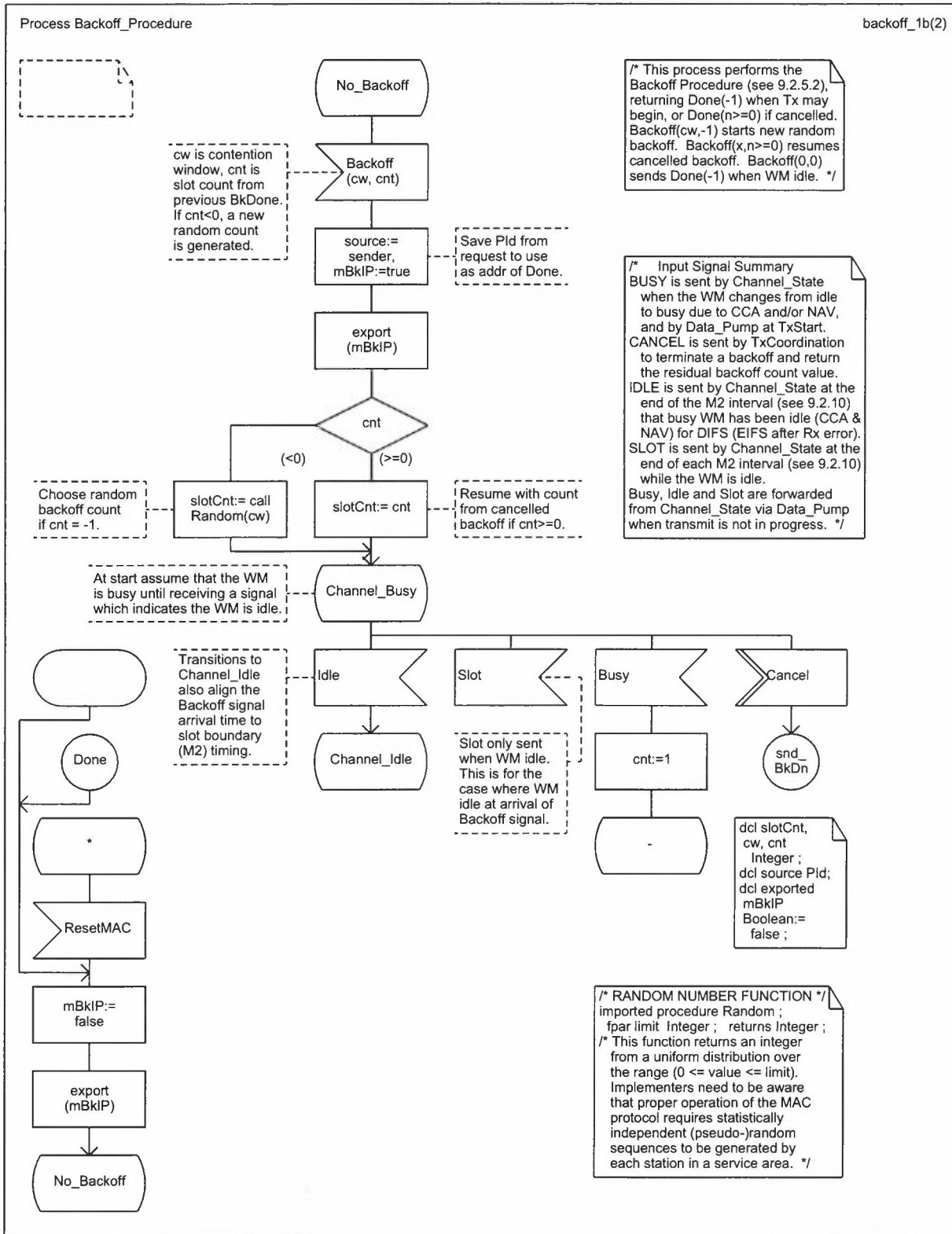


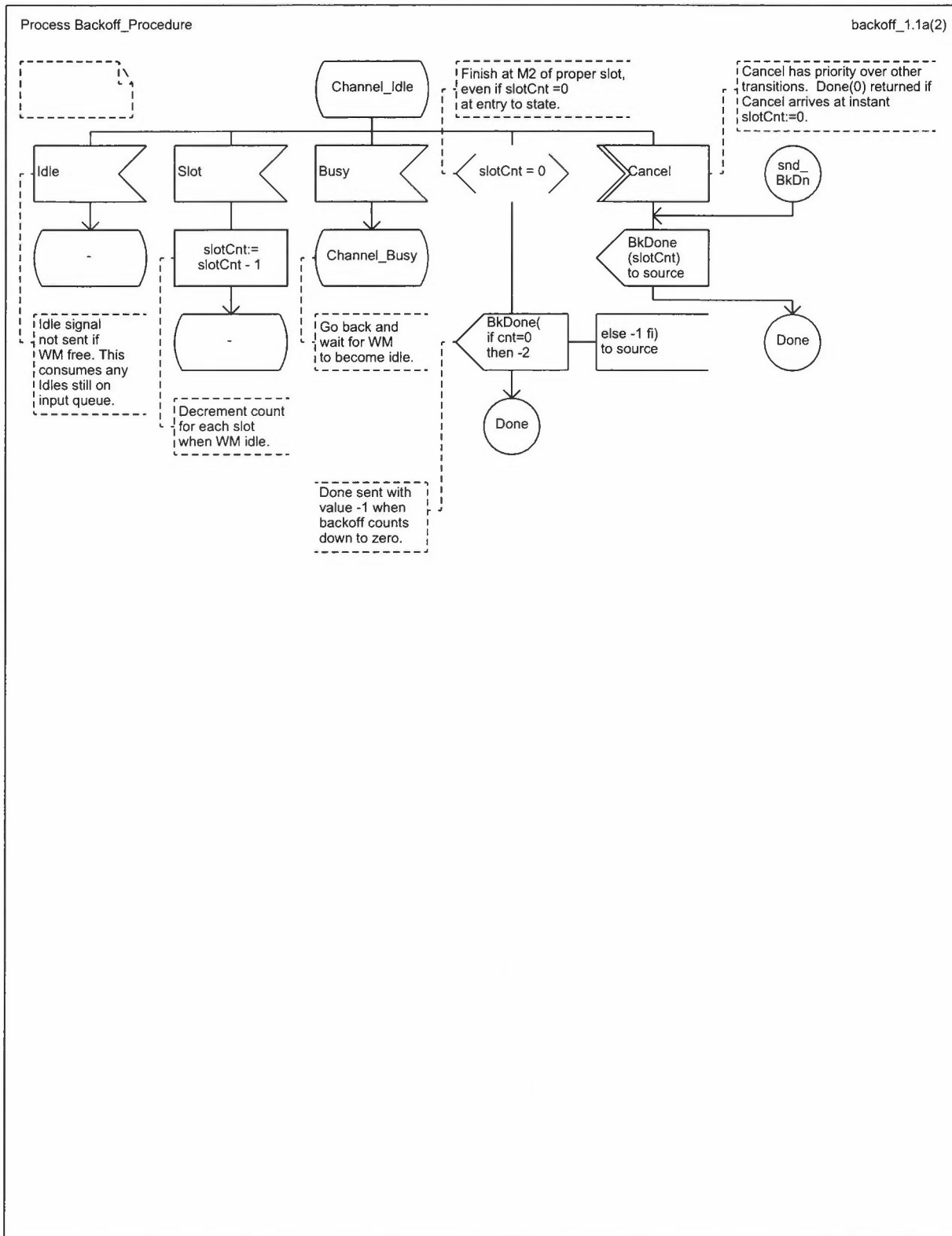


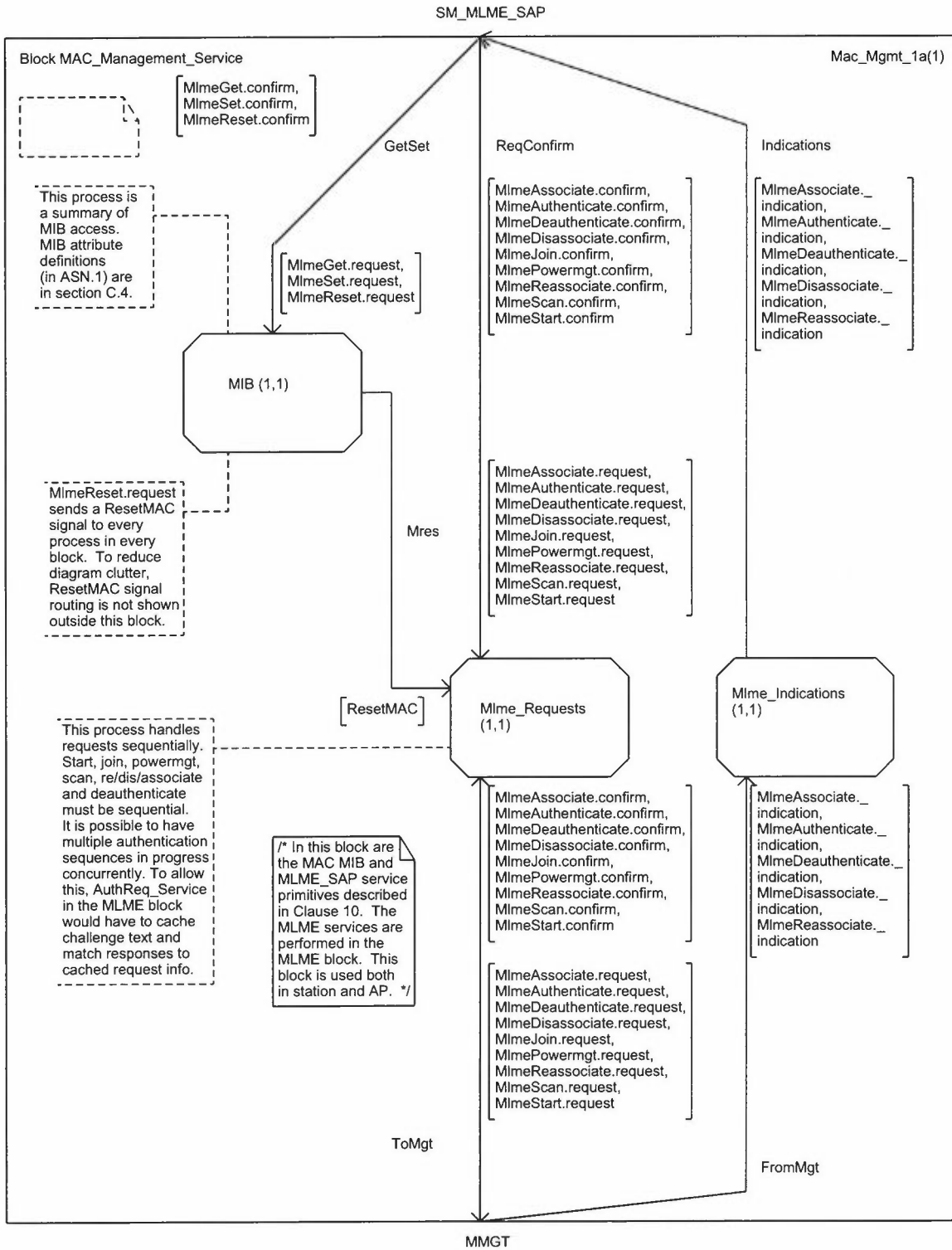


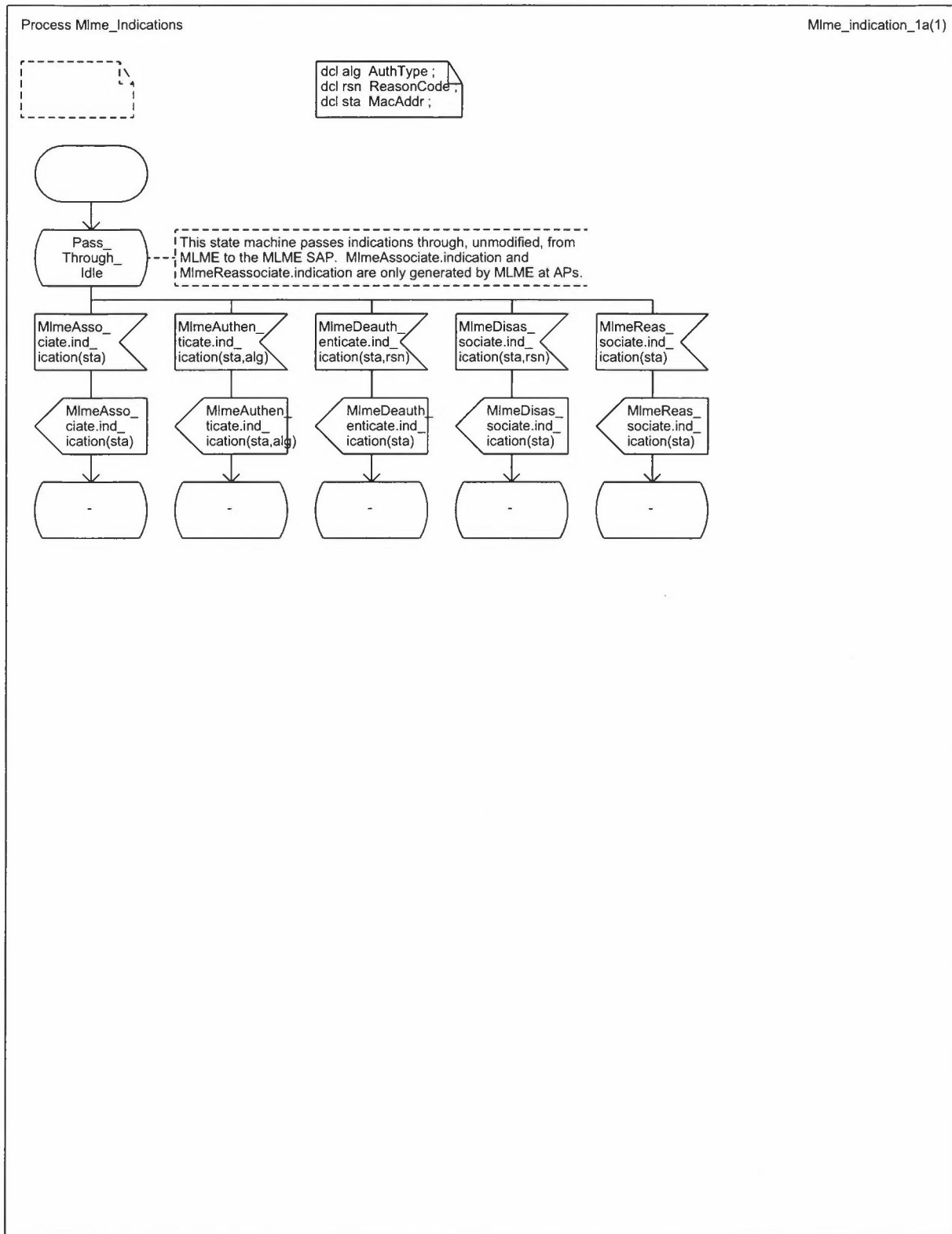


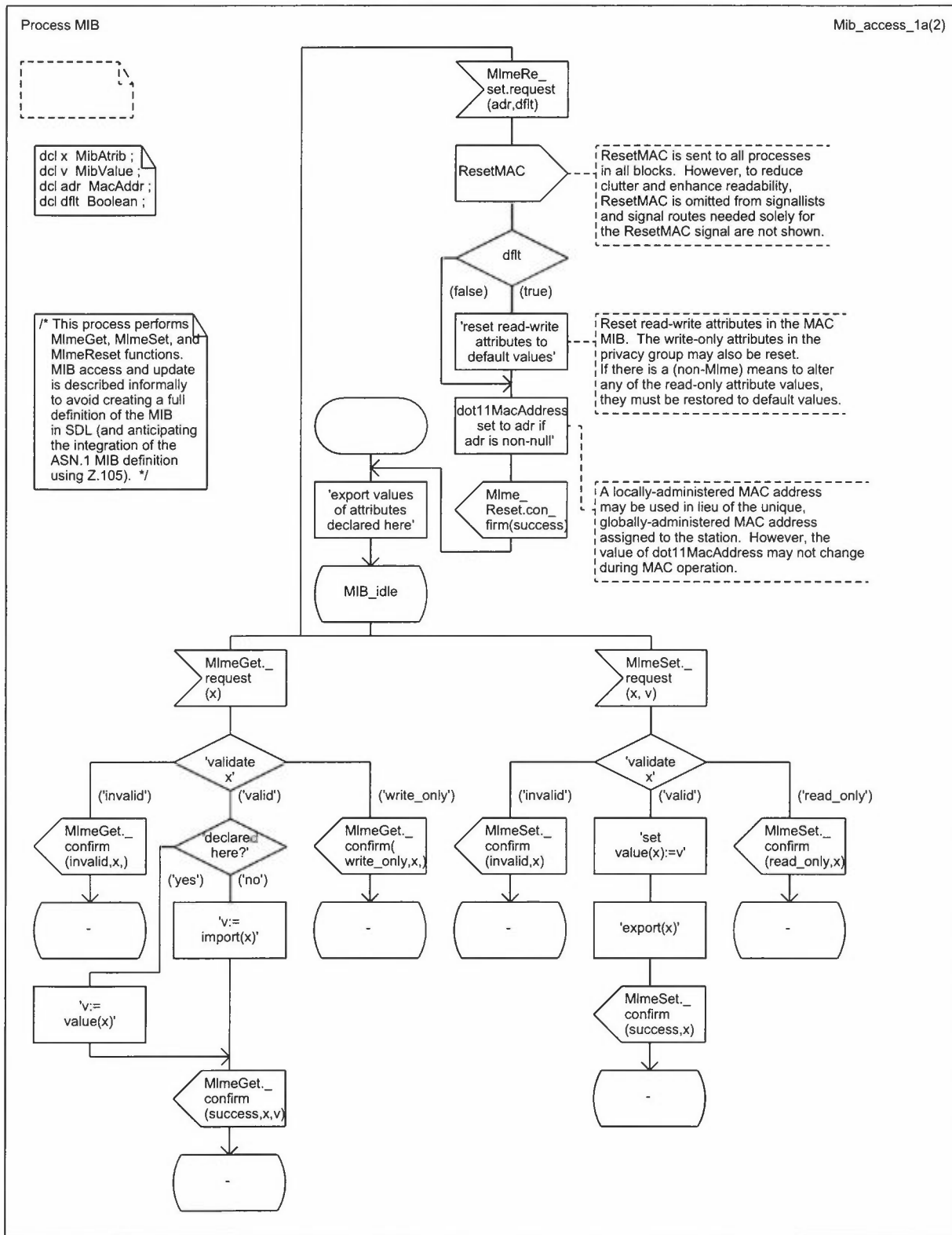












Process MIB

Mib_import_export_2b(2)



```

/* Import of {Read-Only} MIB counter
values exported from other processes */
imported
dot11AckFailureCount,
dot11FailedCount,
dot11FcsErrorCount,
dot11FrameDuplicateCount,
dot11MulticastReceivedFrameCount,
dot11MulticastTransmittedFrameCount,
dot11MultipleRetryCount,
dot11ReceivedFragmentCount,
dot11RetryCount,
dot11RtsFailureCount,
dot11RtsSuccessCount,
dot11TransmittedFragmentCount,
dot11WepExcludedCount,
dot11WepIcvErrorCount,
dot11WepUndecryptableCount Counter32 ;

```

```

/* Declarations of MIB attributes exported from
this process */

/* Read-Write attributes */
dcl exported
dot11AuthenticationAlgorithms AuthTypeSet:=
incl(open_system, shared_key),
dot11ExcludeUnencrypted Boolean:= false,
dot11FragmentationThreshold Integer:= 2346,
dot11GroupAddresses MacAddrSet:= empty,
dot11LongRetryLimit Integer:= 4,
dot11MaxReceiveLifetime Kusec:= 512,
dot11MaxTransmitMsduLifetime Kusec:= 512,
dot11MediumOccupancyLimit Kusec:= 100,
dot11PrivacyInvoked Boolean:= false,
mReceiveDTIMs Boolean:= true,
dot11CfpPeriod Integer:= 1,
dot11CfpMaxDuration Kusec:= 200,
dot11AuthenticationResponseTimeout Kusec:= 512,
dot11RtsThreshold Integer:= 3000,
dot11ShortRetryLimit Integer:= 7,
dot11WepDefaultKeyId KeyIndex:= 0,
dot11CurrentChannelNumber Integer:= 0,
dot11CurrentSet Integer:= 0,
dot11CurrentPattern Integer:= 0,
dot11CurrentIndex Integer:= 0 ;

/* Write-Only attributes */
dcl exported
dot11WepDefaultKeys KeyVector:= nullKey,
dot11WepKeyMappings
KeyMapArray:= (. nullAddr, false, nullKey .) ;

```

```

/* The following Read-Only attributes in the
MAC MIB are defined as synonyms (named
constants) rather than remote variables
because they describe properties of the
station which are static, at least during
any single instance of MAC operation:
dot11AuthenticationAlgorithms AuthTypeSet,
dot11CfpPollable Boolean,
dot11MacAddress MacAddr,
dot11ManufacturerID Octetstring,
dot11PrivacyOptionImplemented Boolean,
dot11ProductID Octetstring,
aStationID MacAddr,
dot11WepKeyMappingLength Integer ;

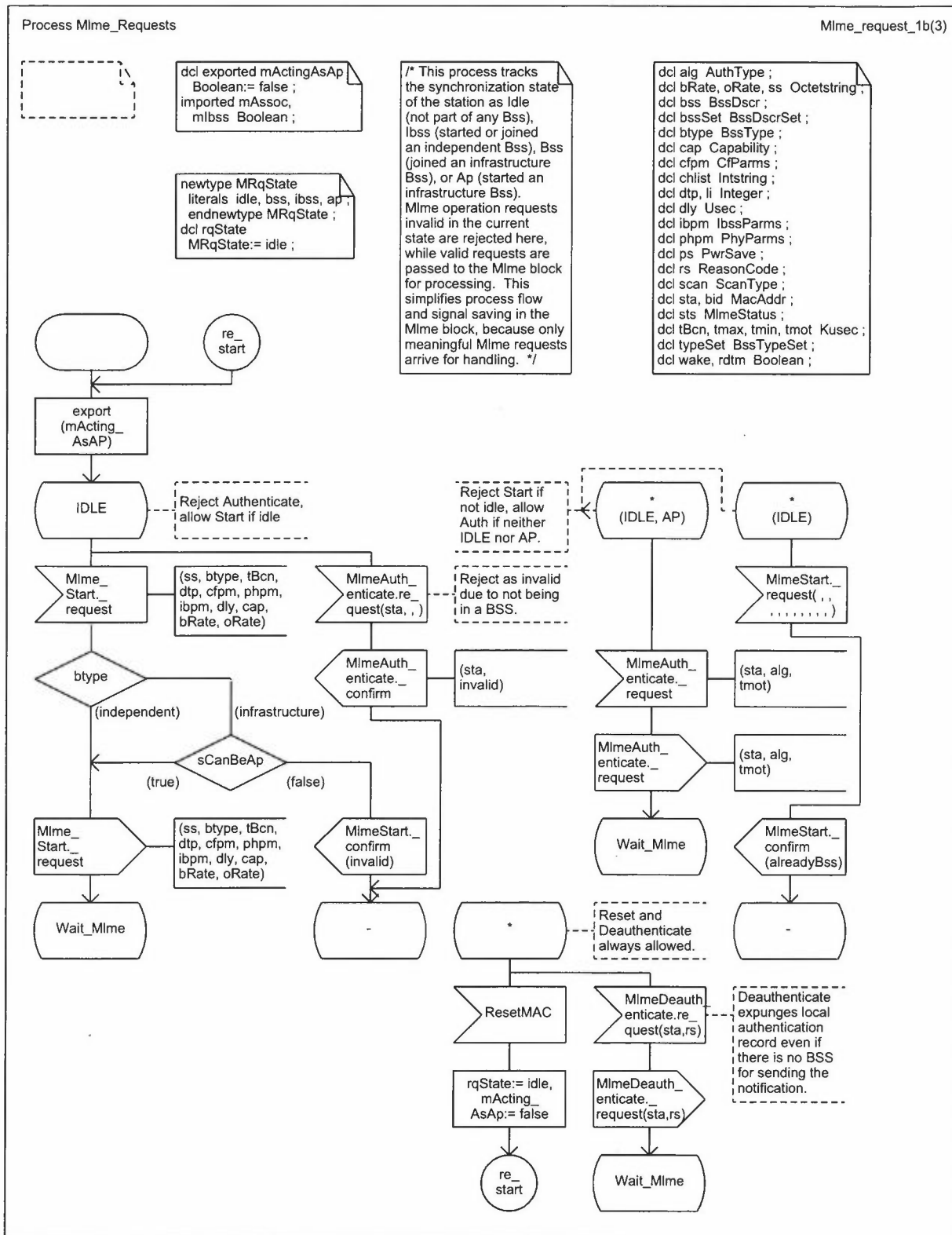
In addition, all Read-Only attributes in the
PHY MIB which are accessed by the MAC
are defined as synonyms.
*/

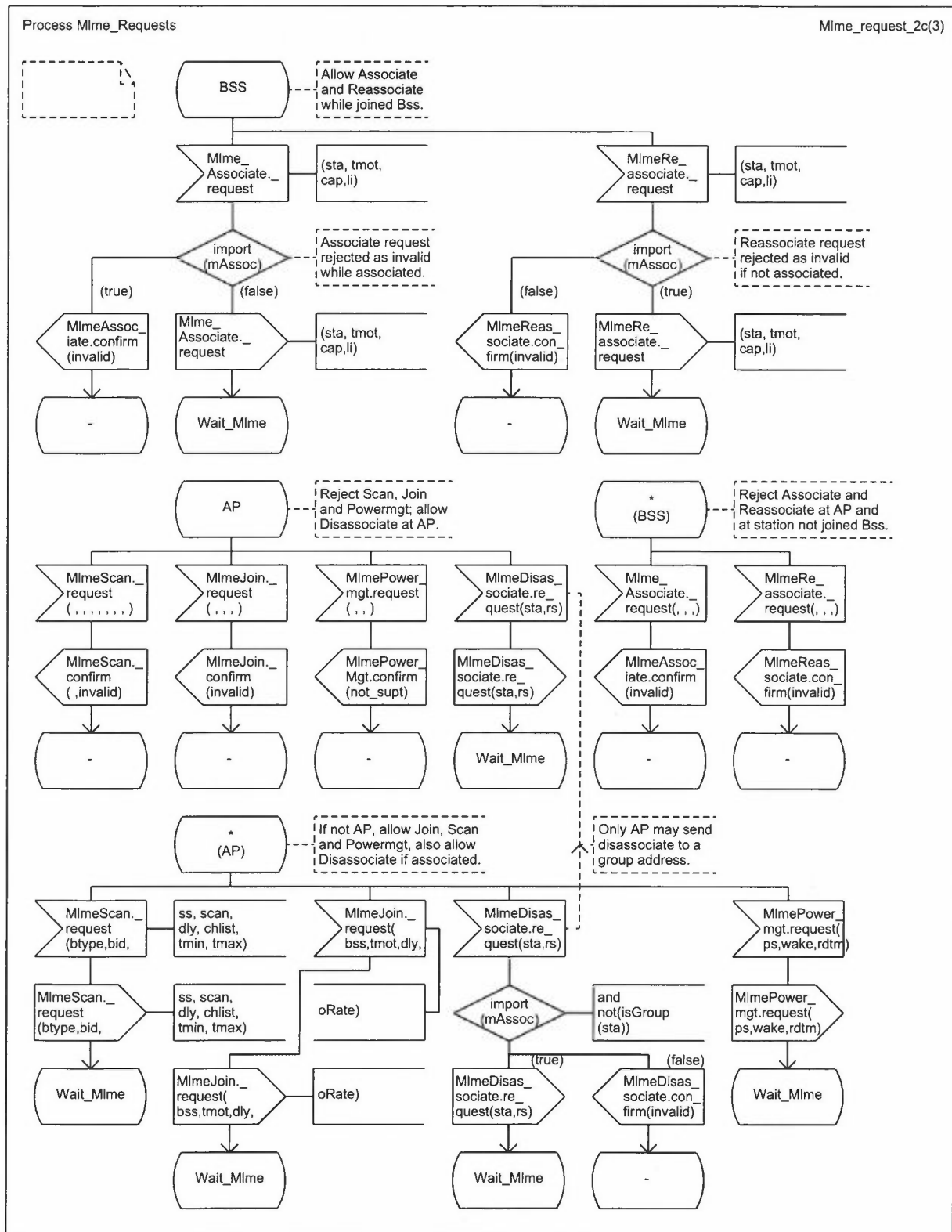
```

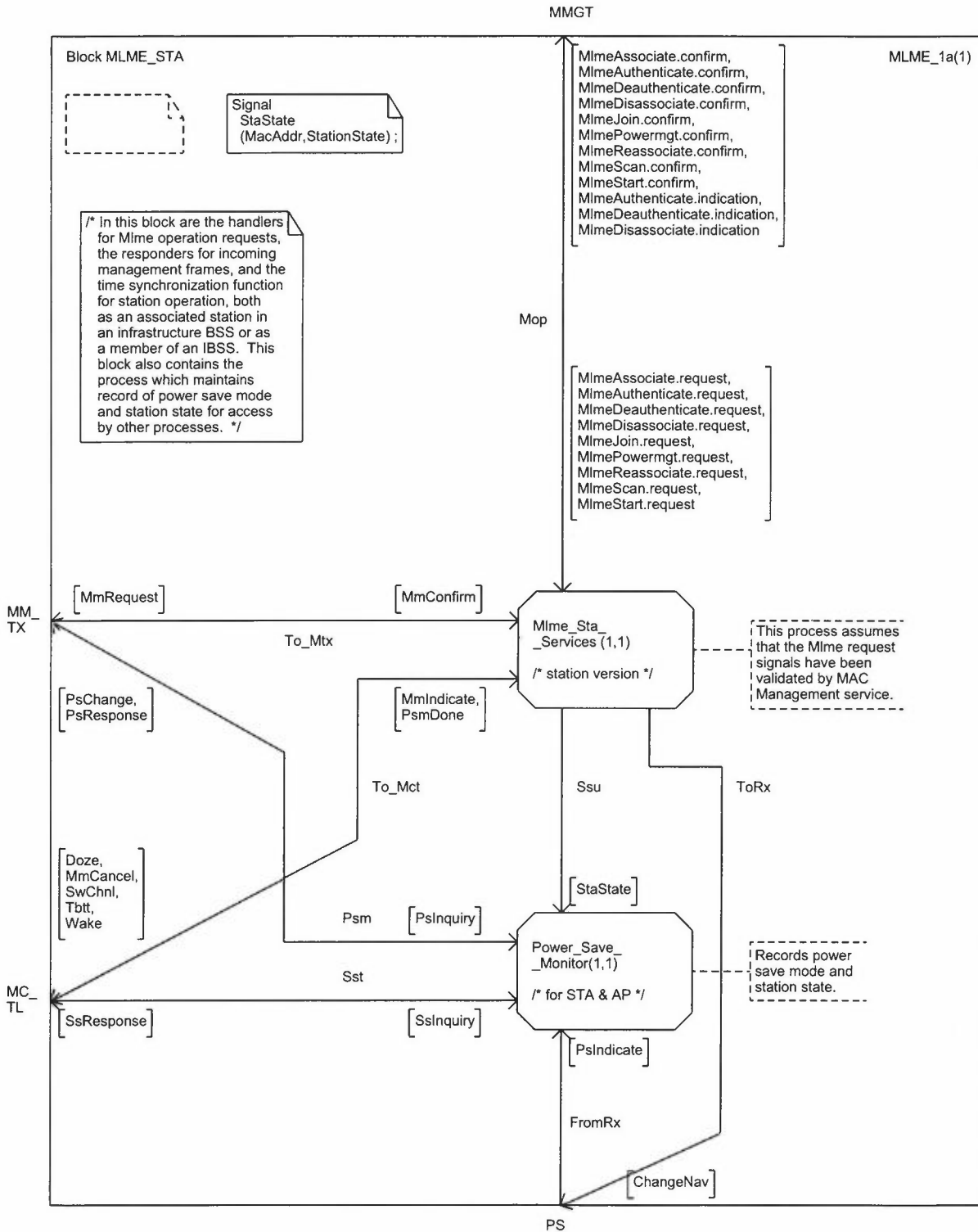
```

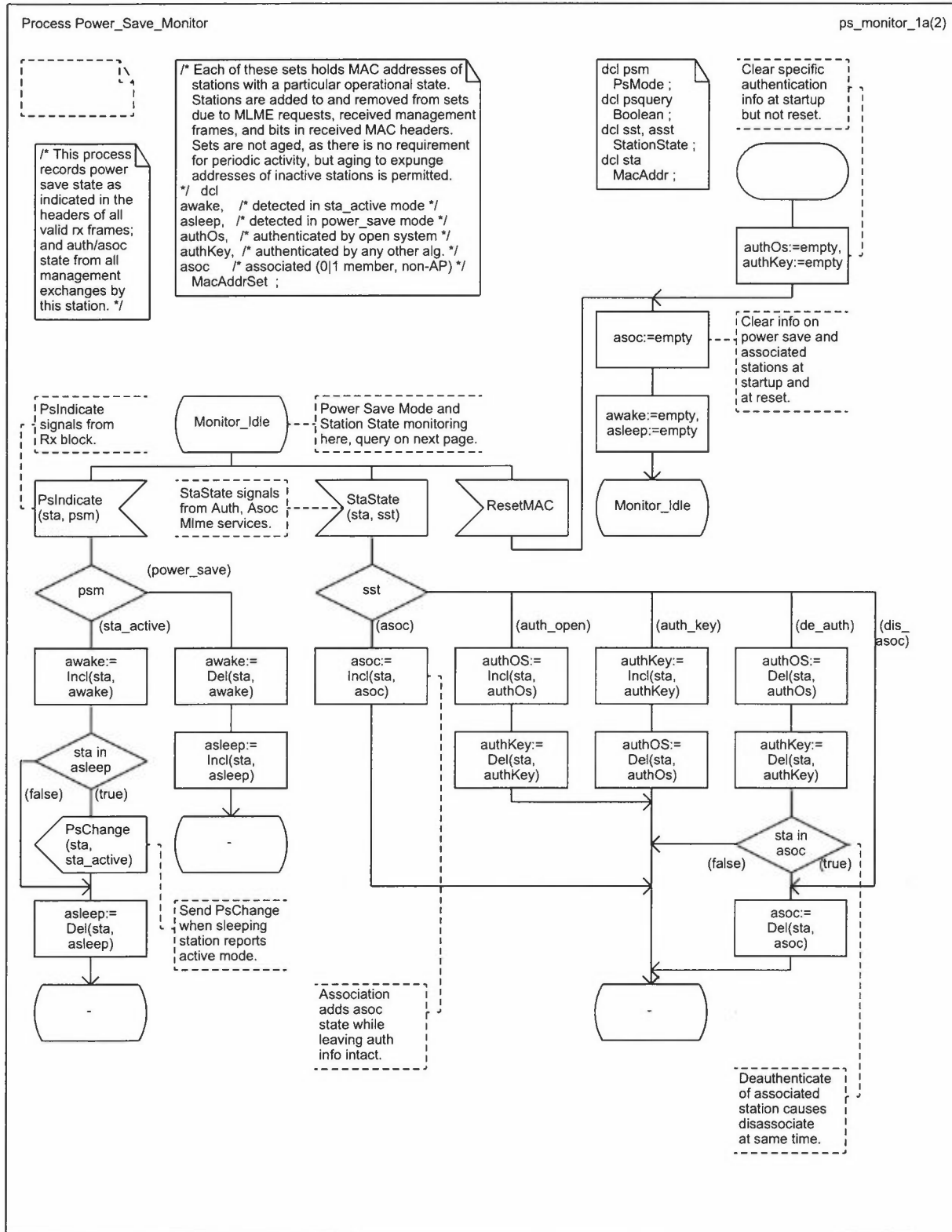
/* NOTE:
The values listed for MAC MIB attributes are the
specified default values for those attributes.
The values listed for PHY MIB attributes are either
the default values for the FH PHY, or arbitrary
values within the specified range. The specific
values for PHY attributes in this SDL description
of the MAC do not have normative significance.
*/

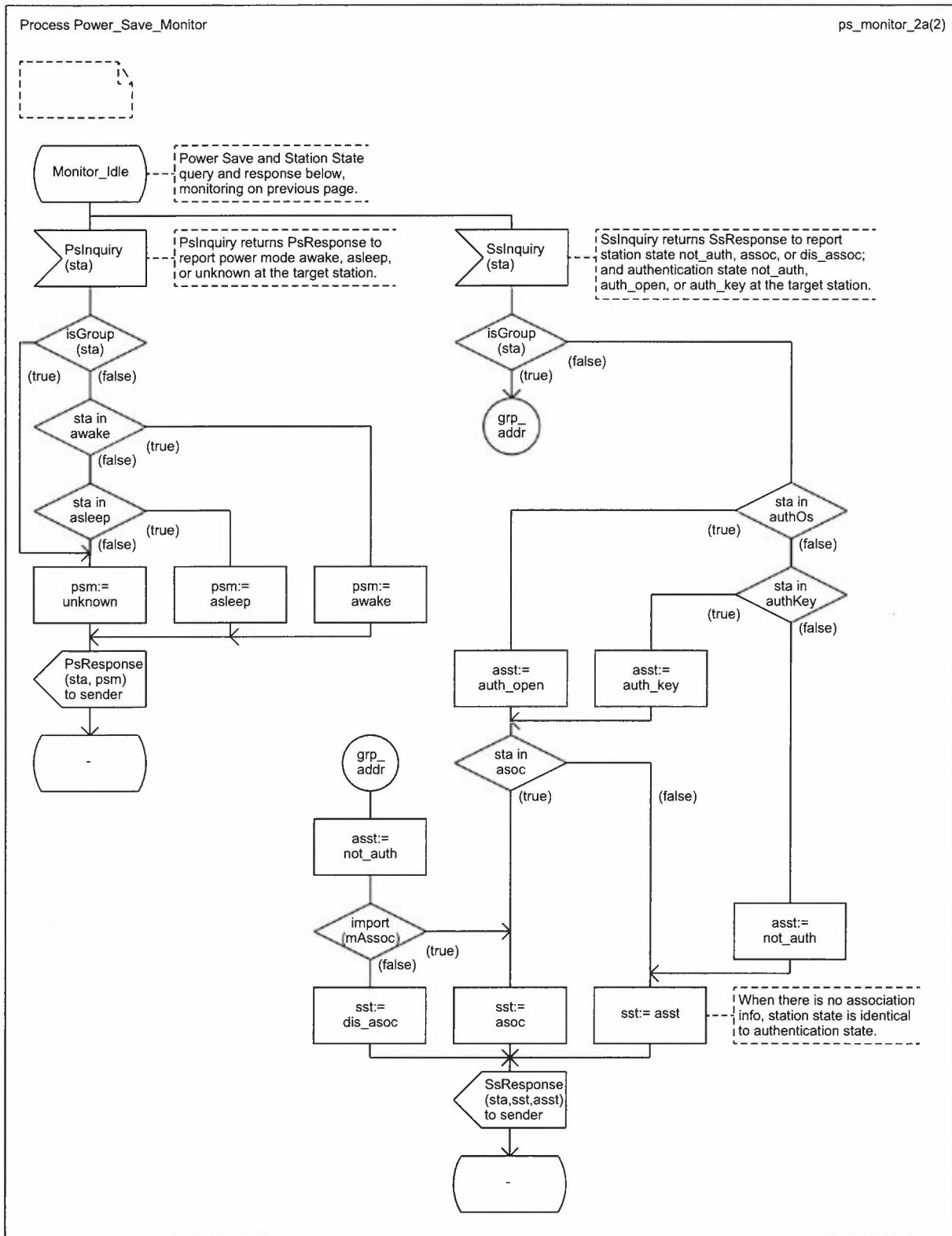
```

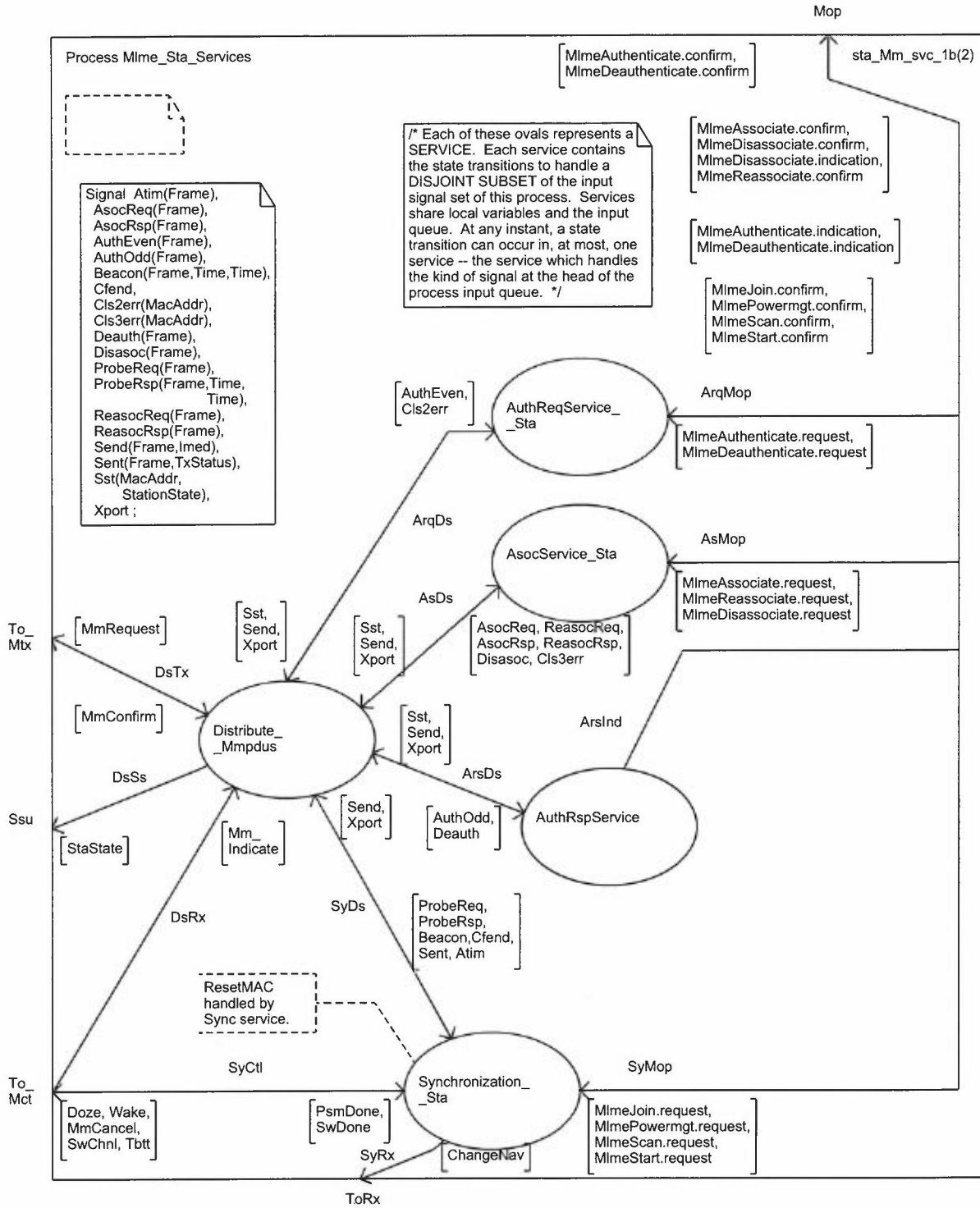












Process Mlme_Sta_Services

sta_Mm_svc_1.1a(2)



```

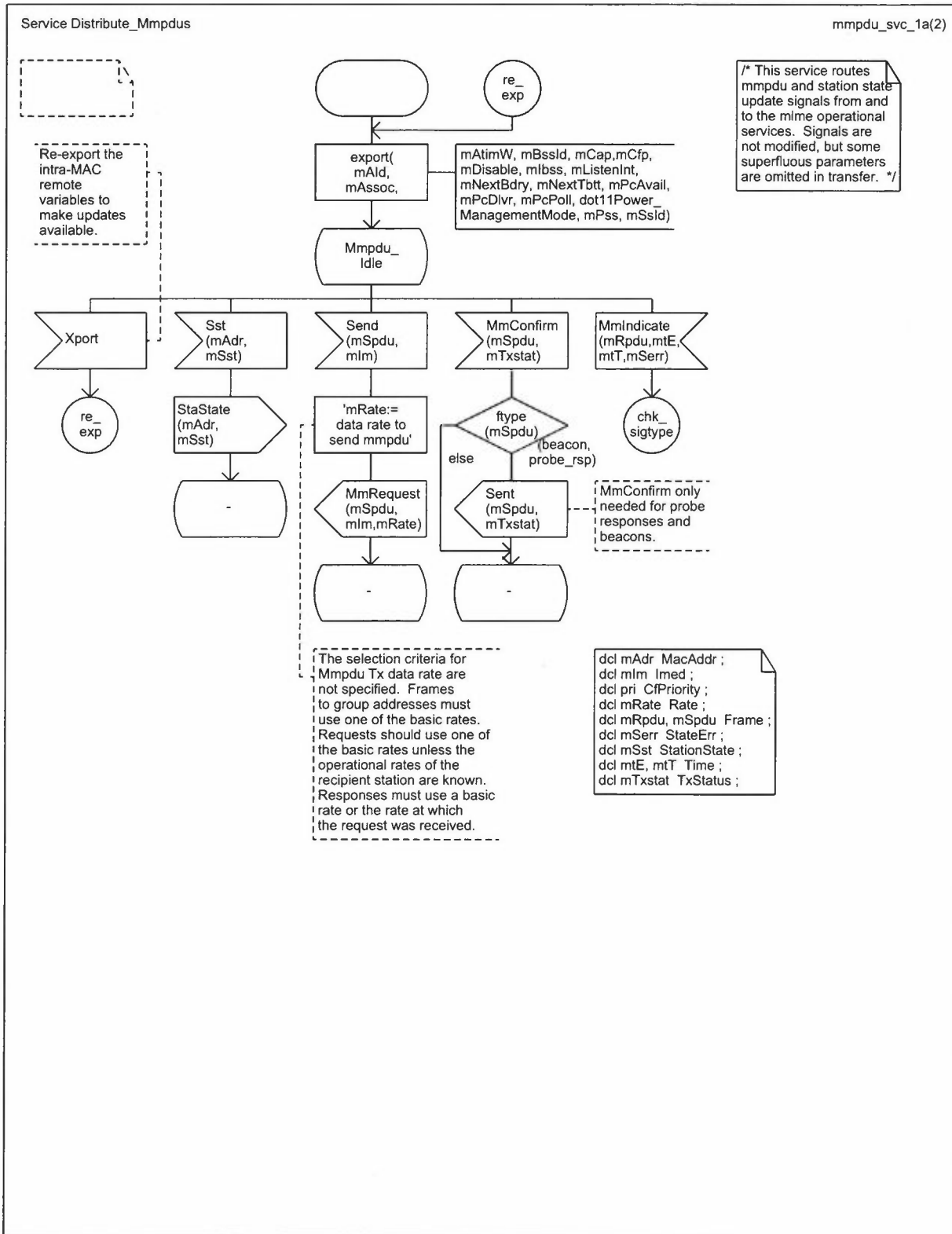
Timer Tasoc,
Tauth, Tchal,
Tbcn, Tatim ;

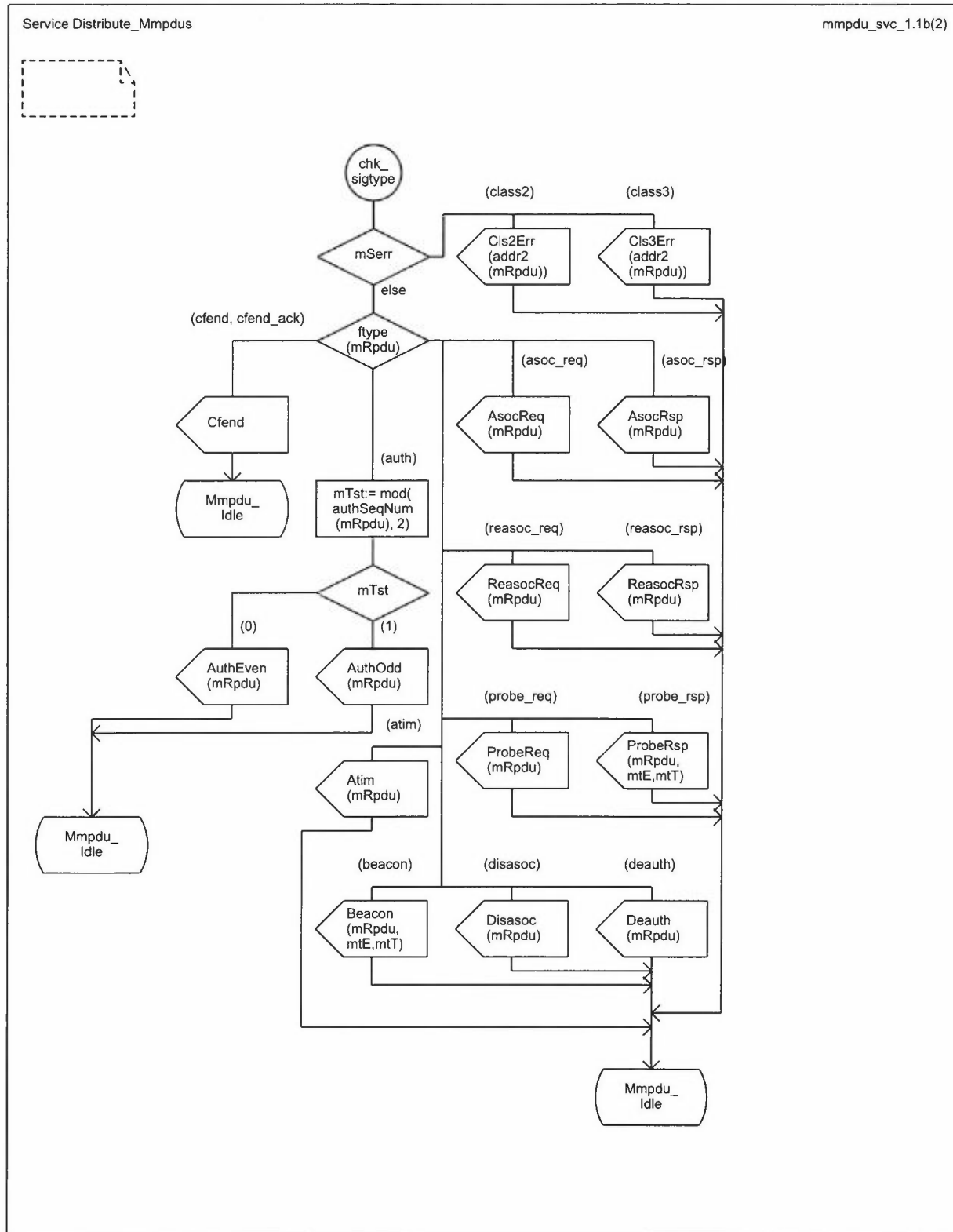
```

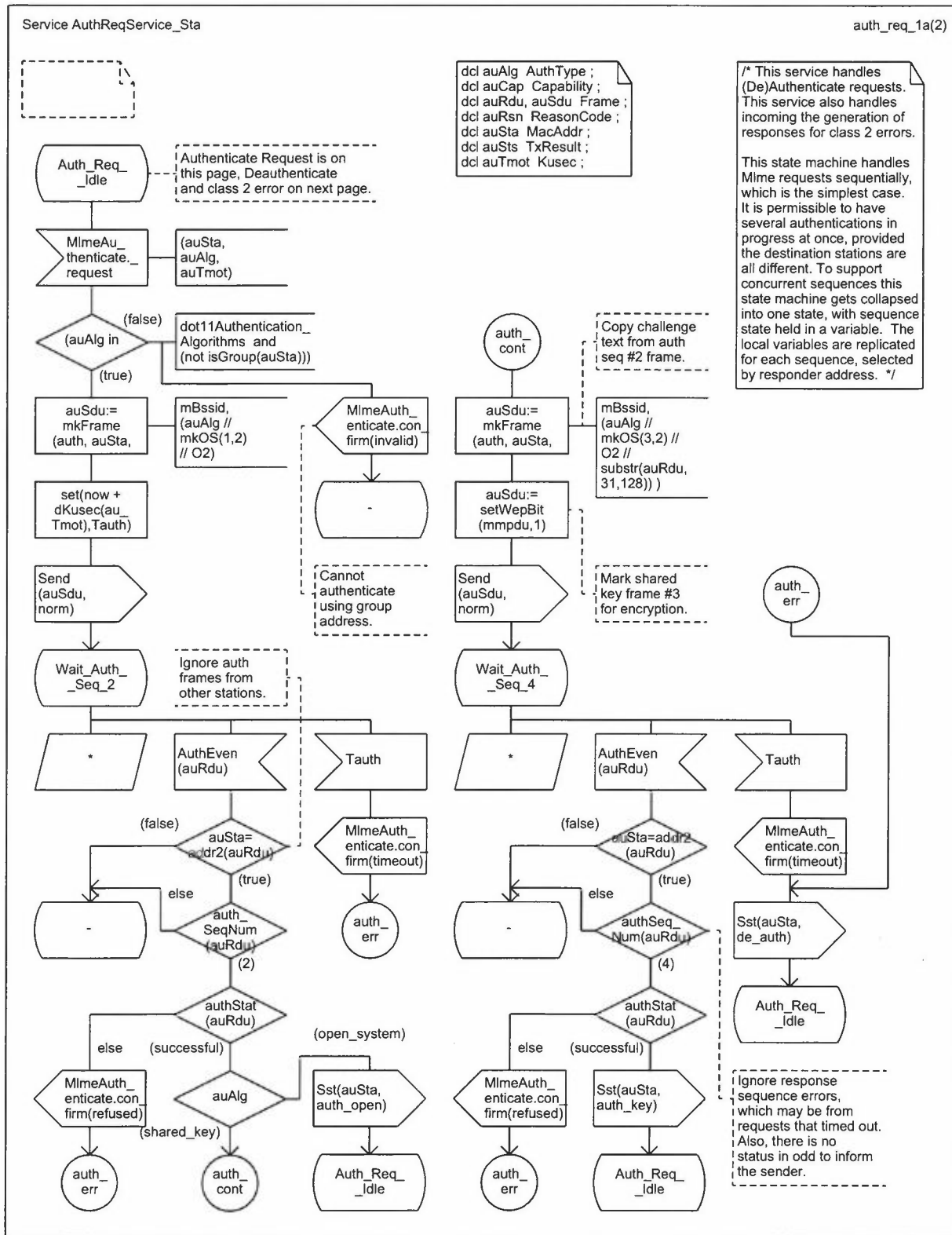
```

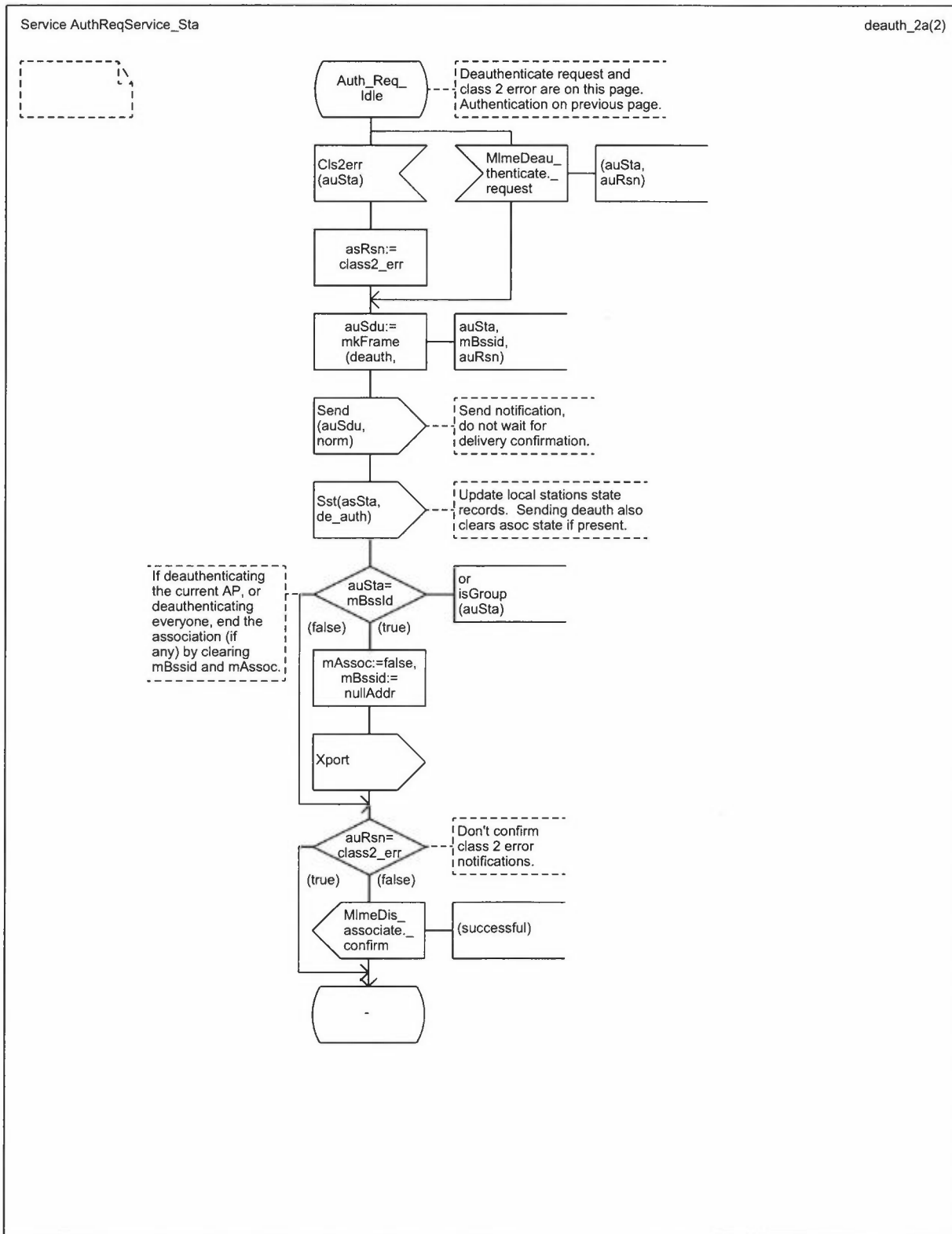
/* Intra-MAC remote variables */
dcl exported
dot11PowerManagementMode PwrSave:= sta_active,
dot11DesiredSsid Octetstring,
dot11DesiredBssType,
dot11OperationalRateSet Ratestring:= mkOS(2,1),
dot11BeaconPeriod TU,
dot11DtimPeriod Integer:= 1,
dot11AssociationResponseTimeOut TU,
mAld AssocId:= 0,
mAssoc Boolean:= false,
mAtimW Boolean:= false,
mBrates Ratestring:=mkOS(2,1),
mBssid MacAddr:= nullAddr,
mCap Octetstring:= O2,
mCfp Boolean:= false,
mDisable Boolean:= true,
mDtimCount Integer:= 1,
mIbss Boolean:= false,
mNextBdry Time:= 0,
mNextTbtt Time:= 0,
mPcAvail Boolean:= false,
mPcPoll Boolean:= false,
mPdly Usec:= 0,
mPss PsState:= awake,
mSsid Octetstring:= null;

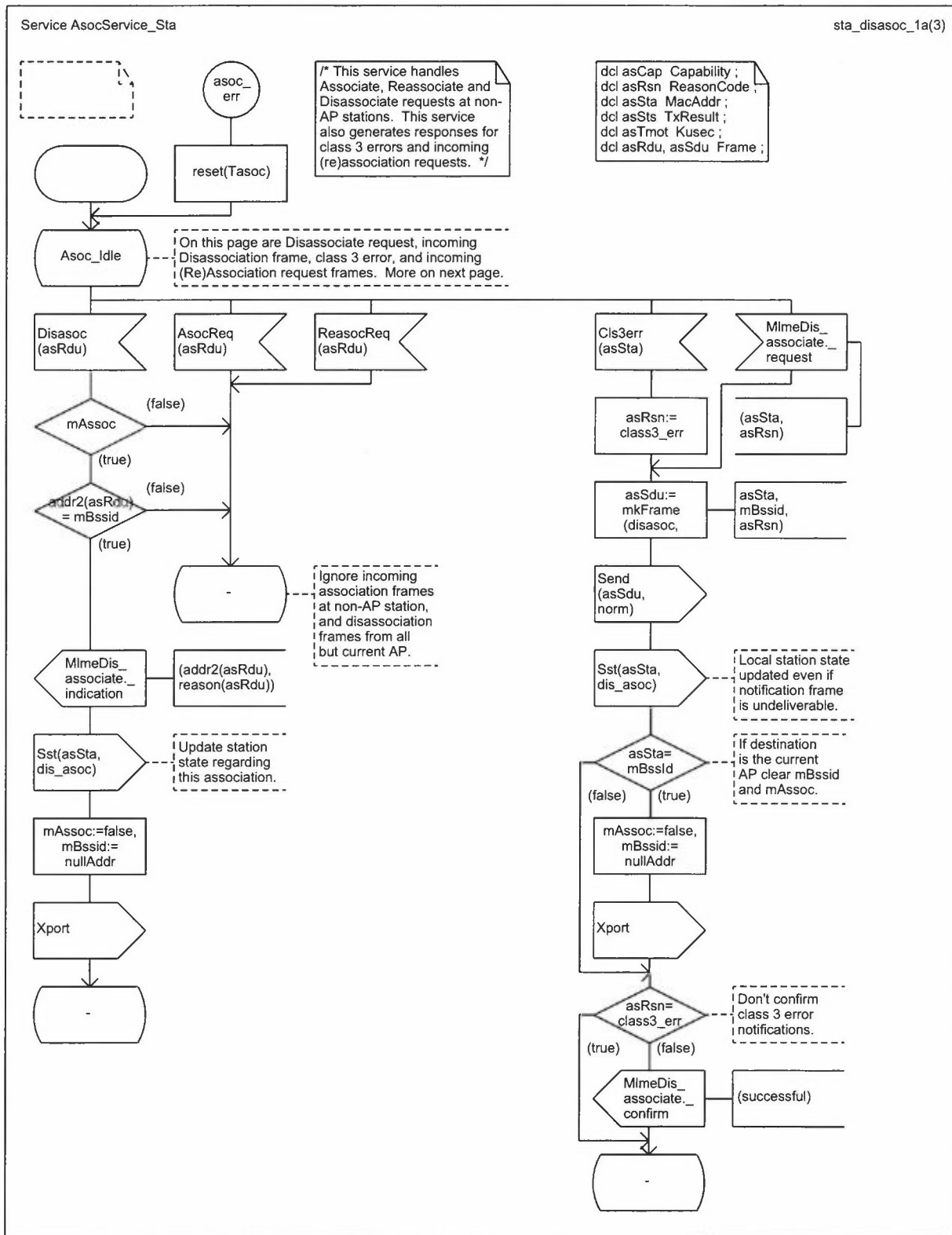
```

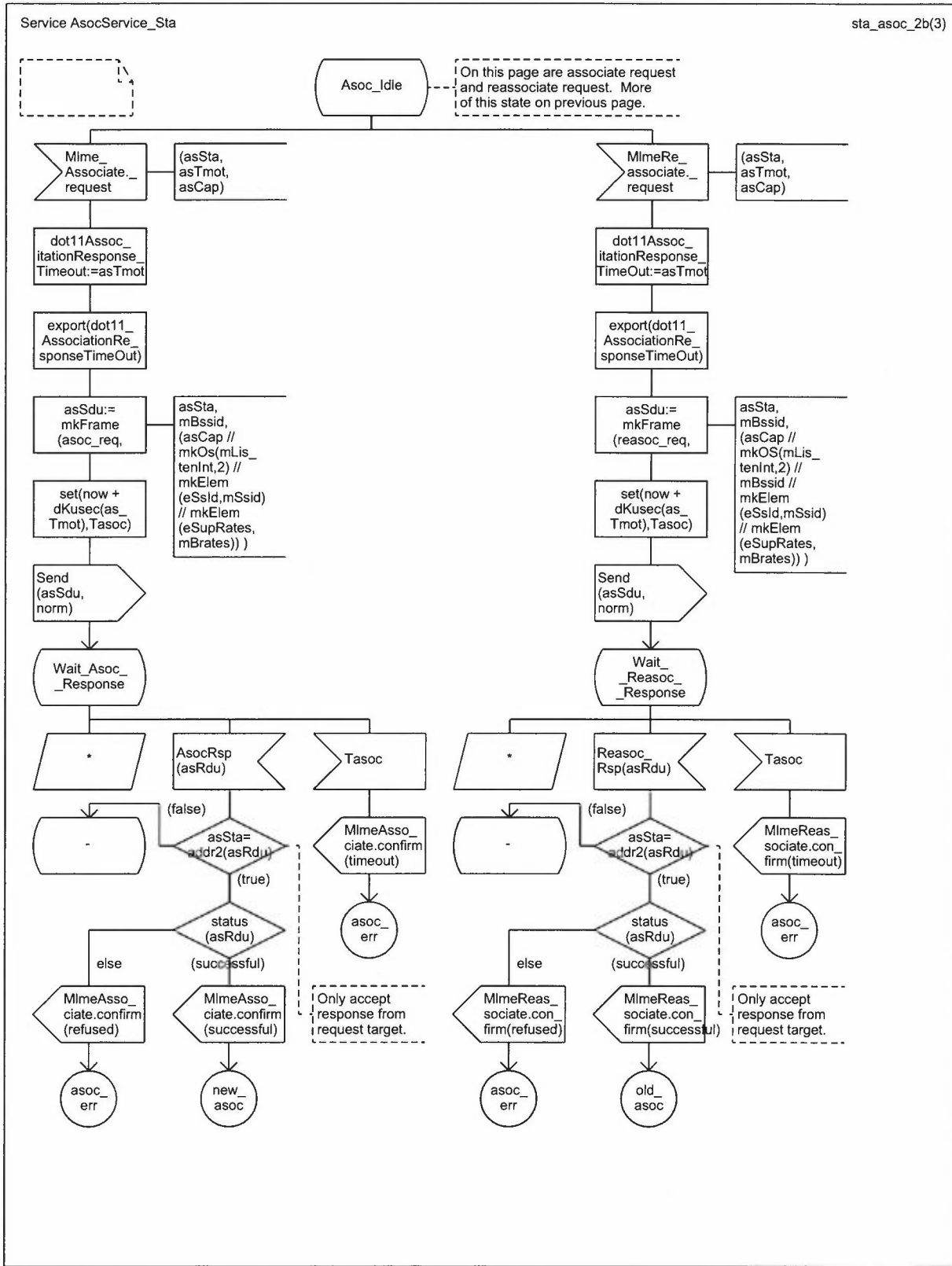


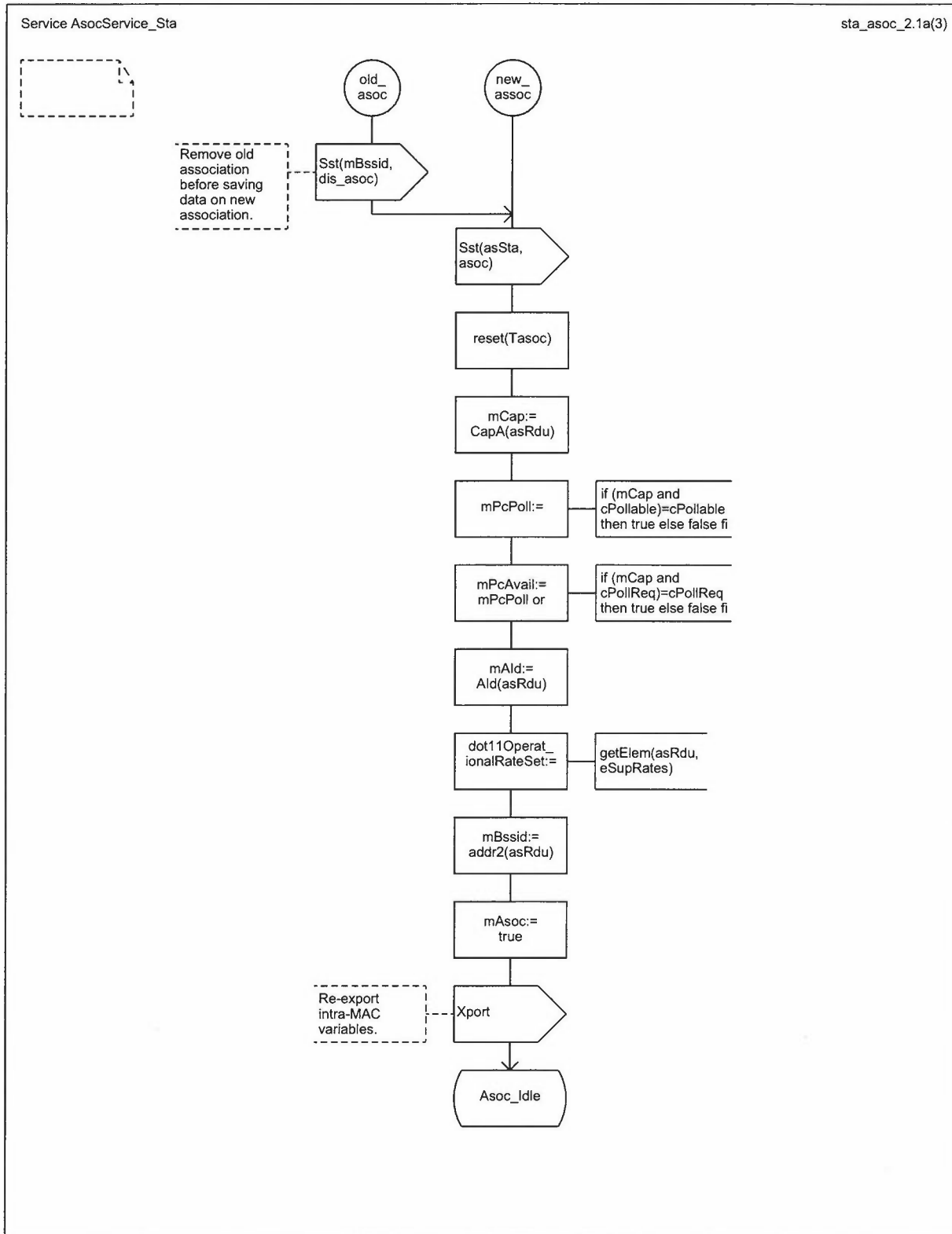


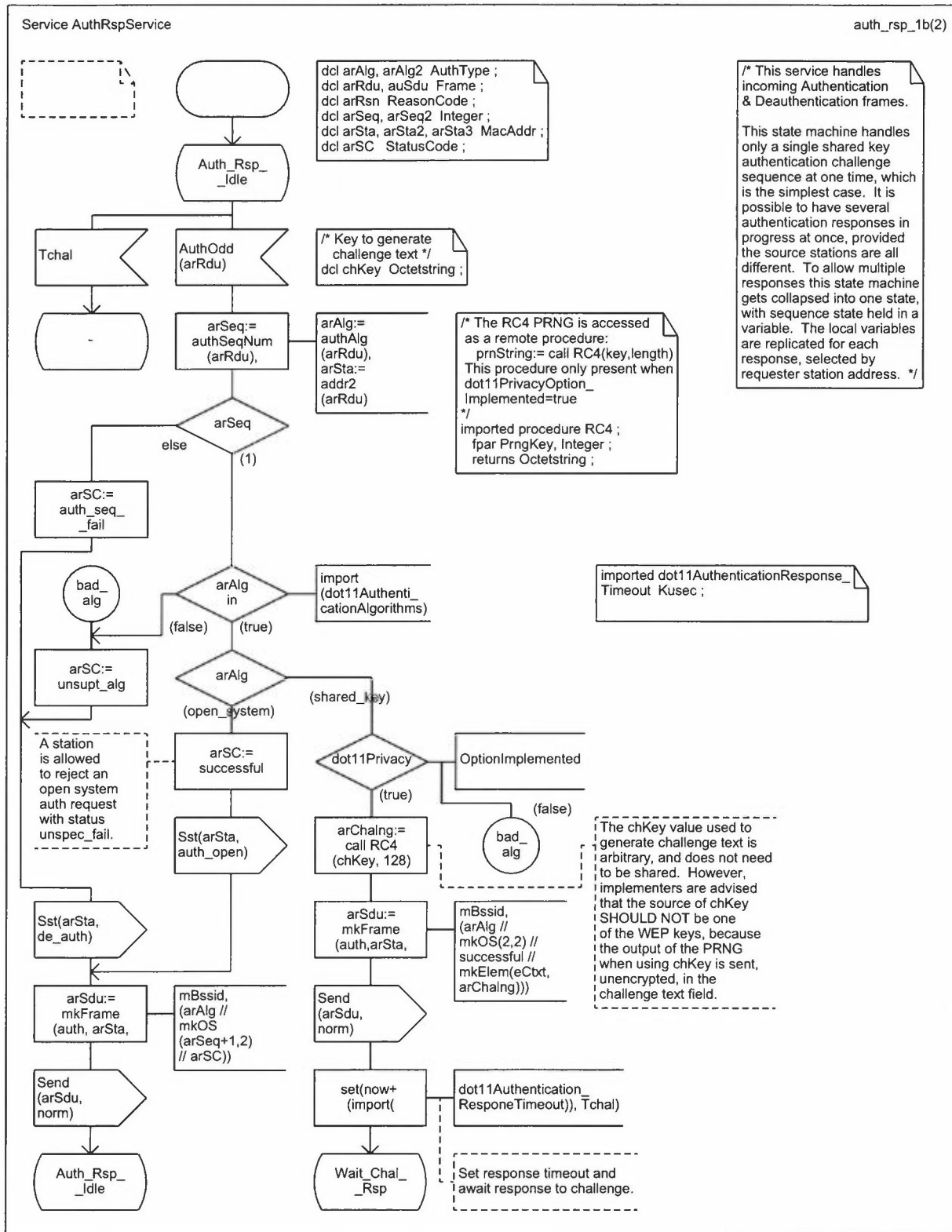


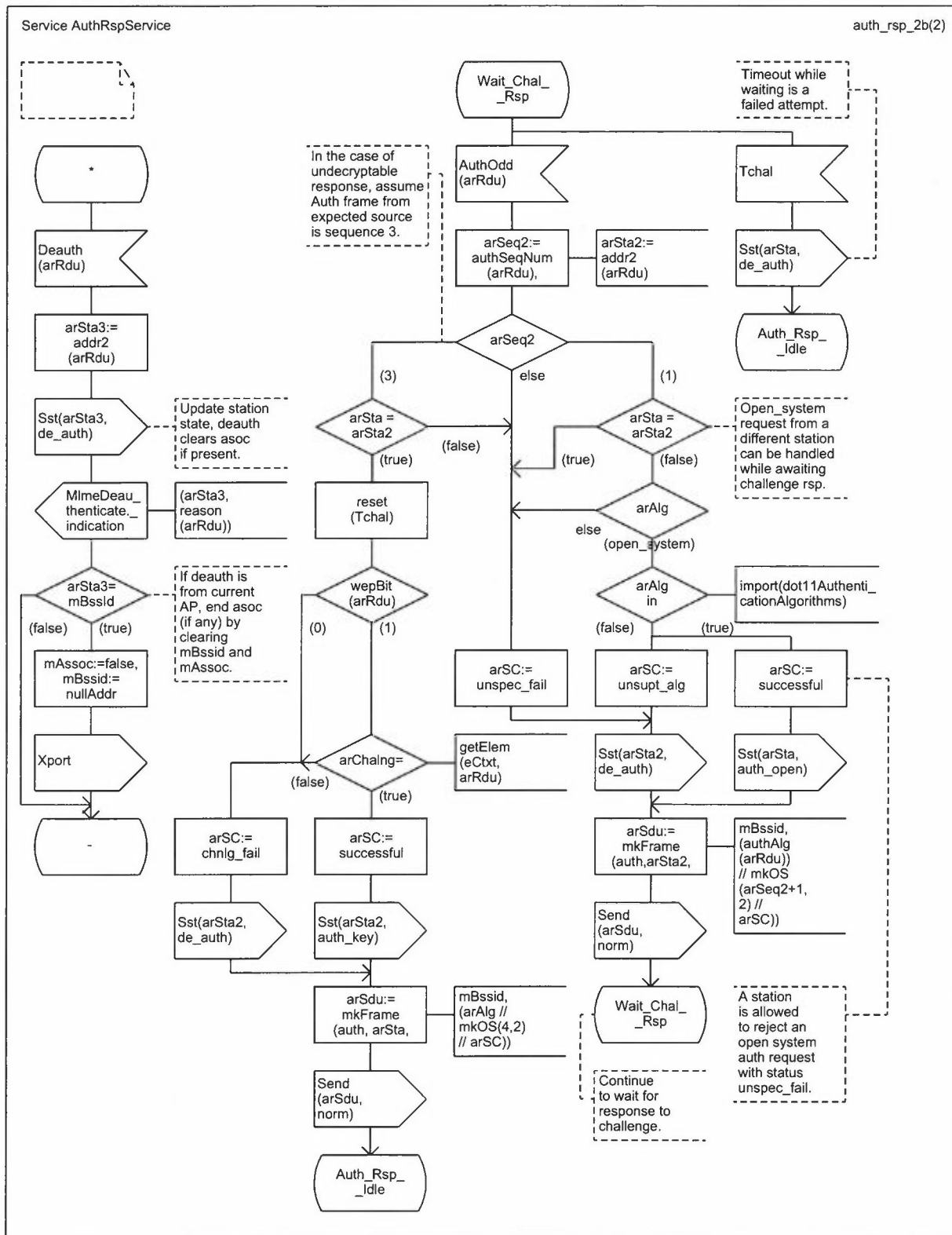


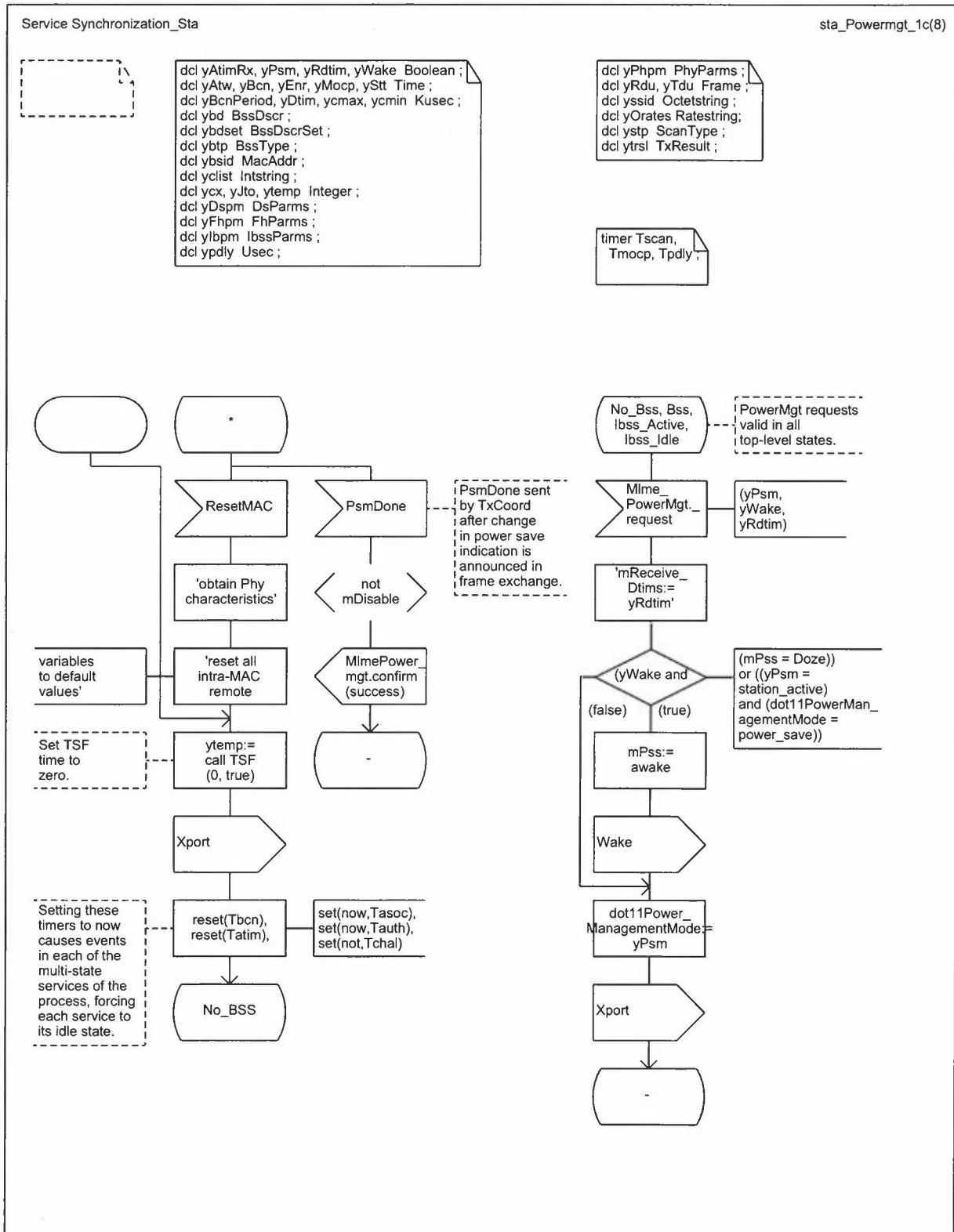


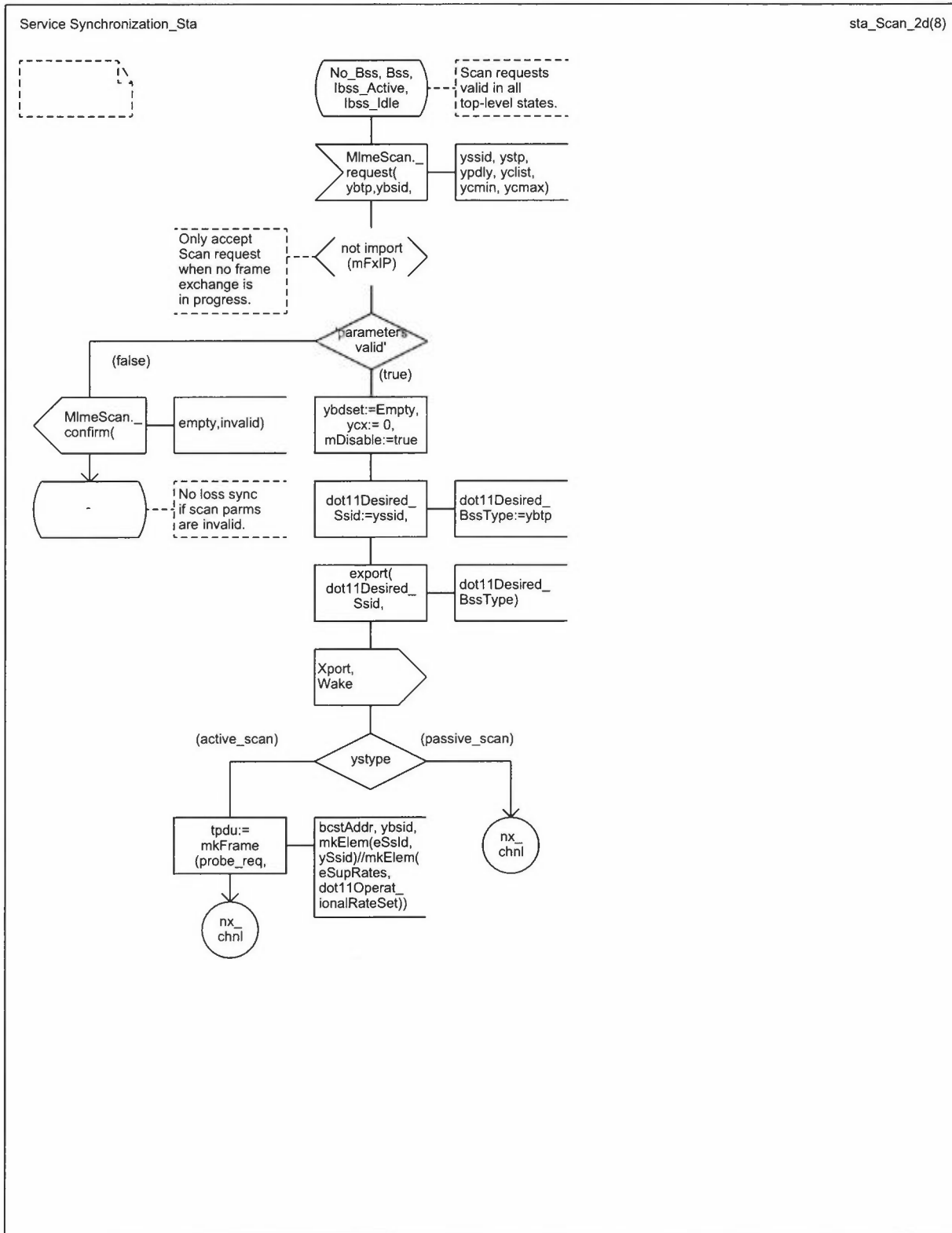


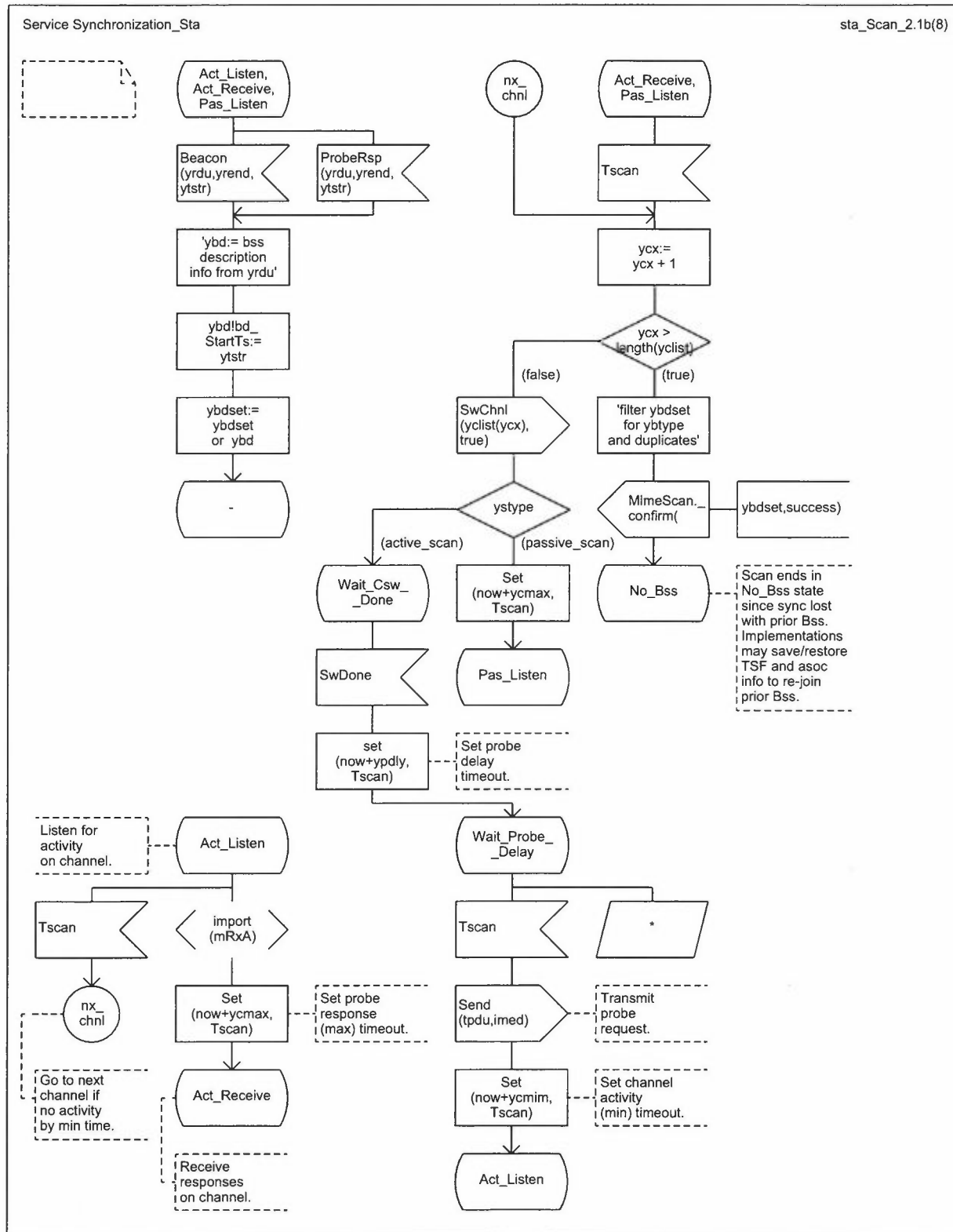


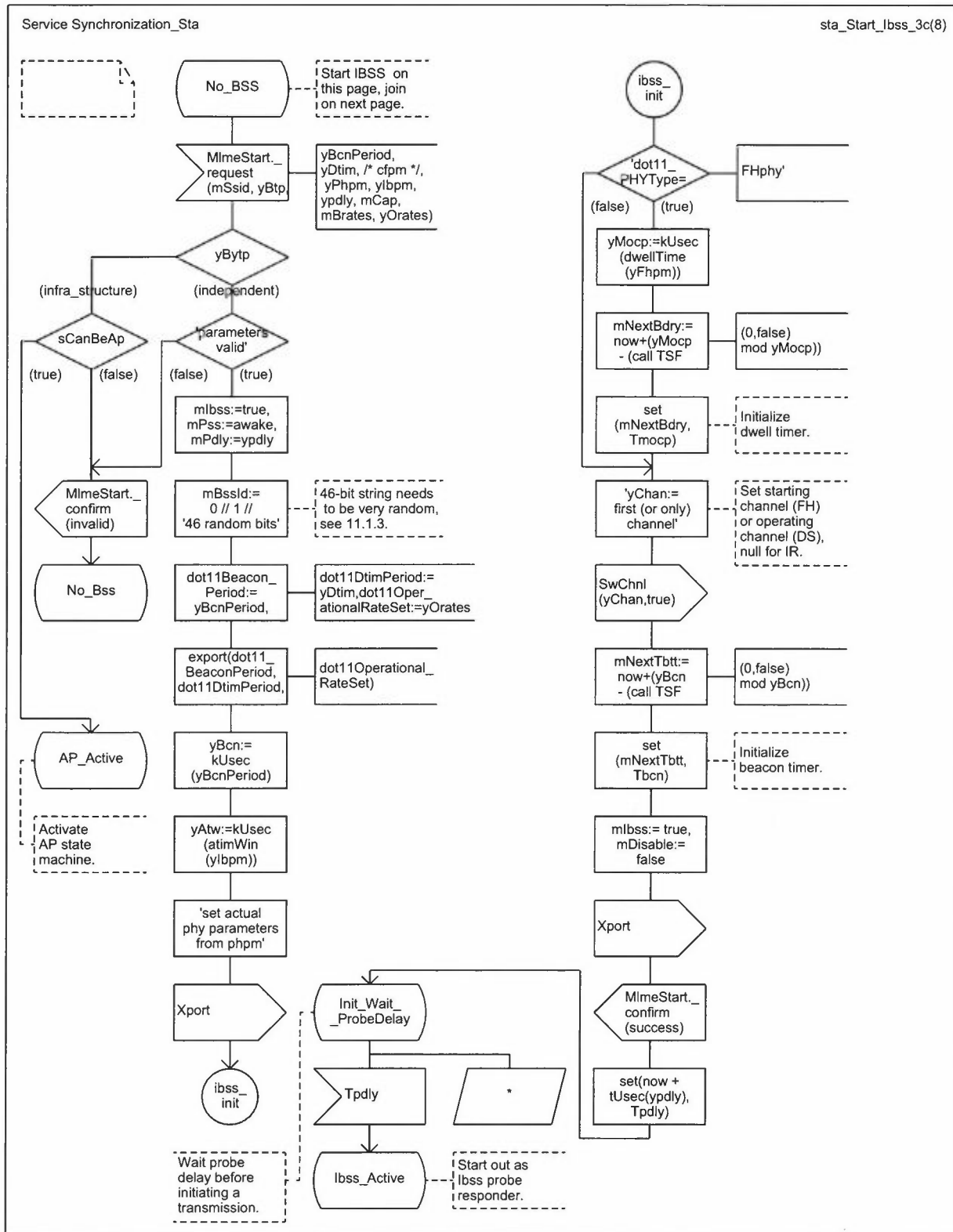


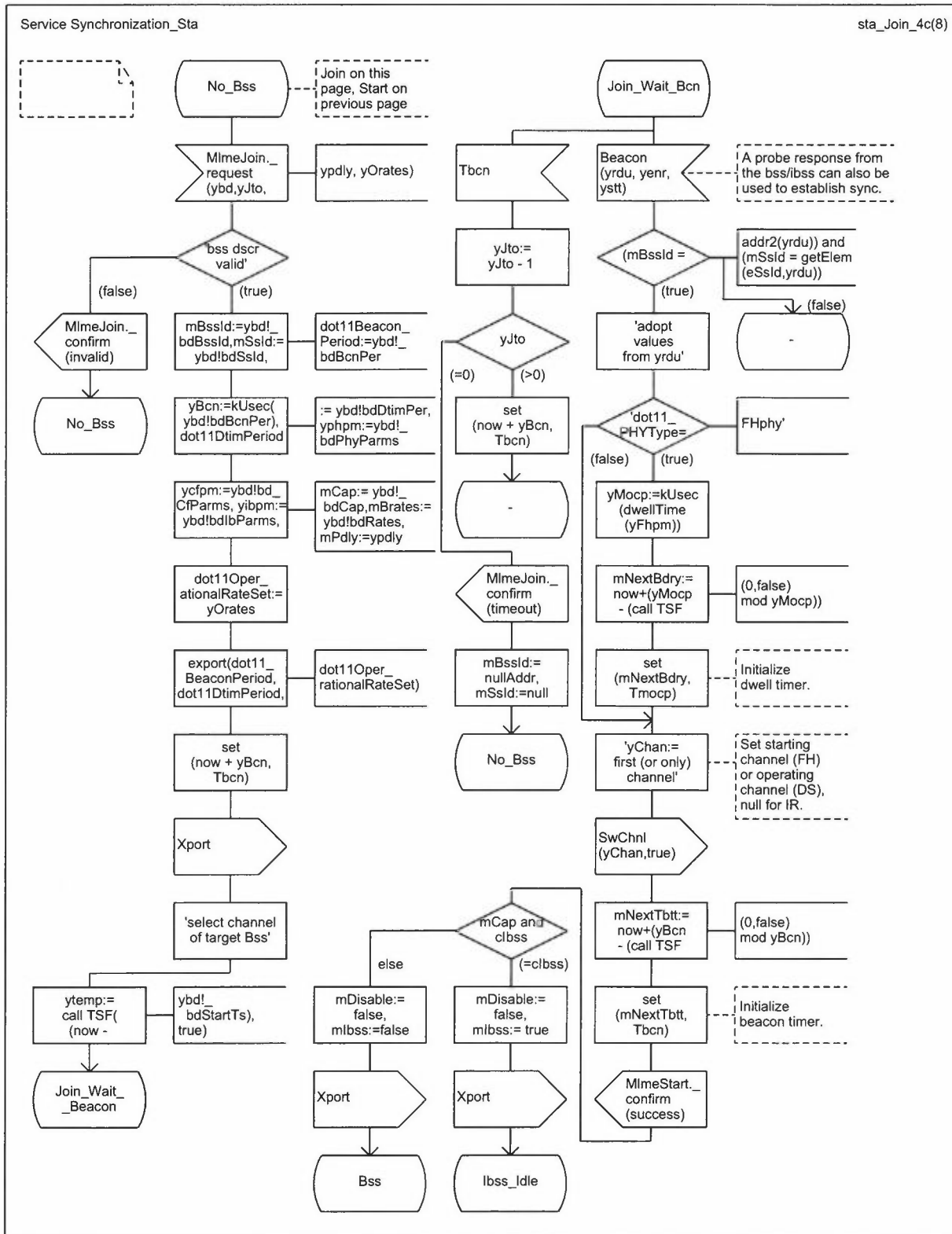


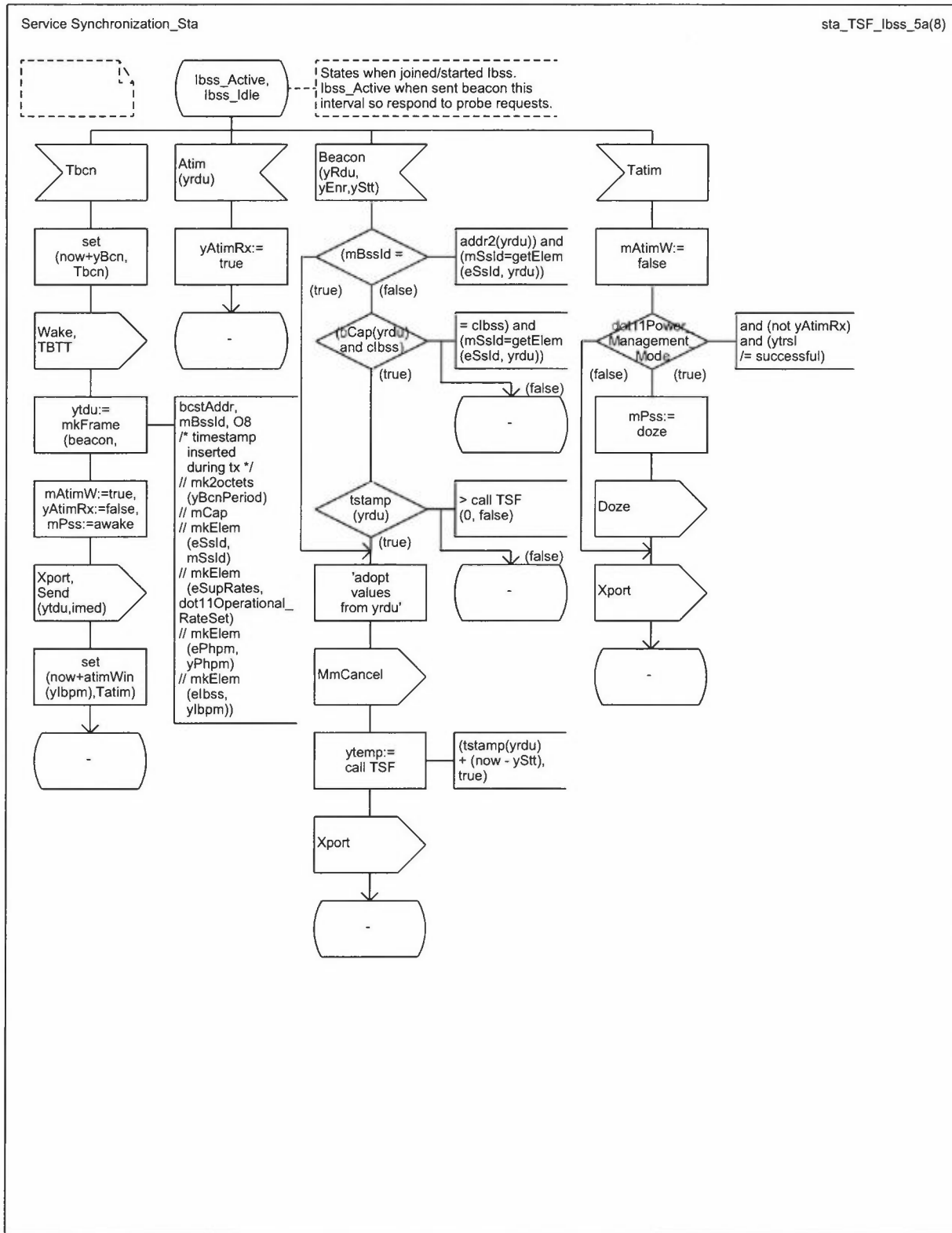


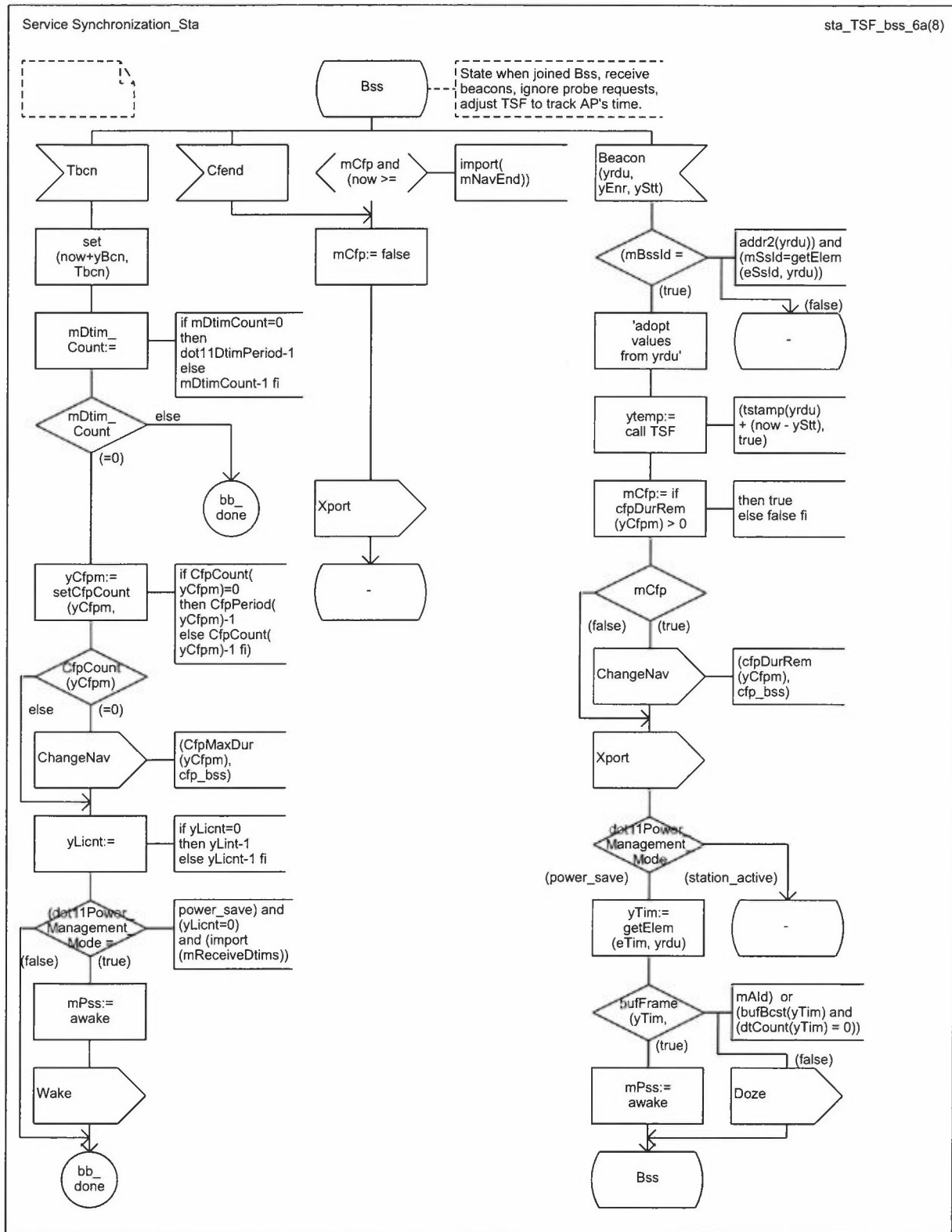


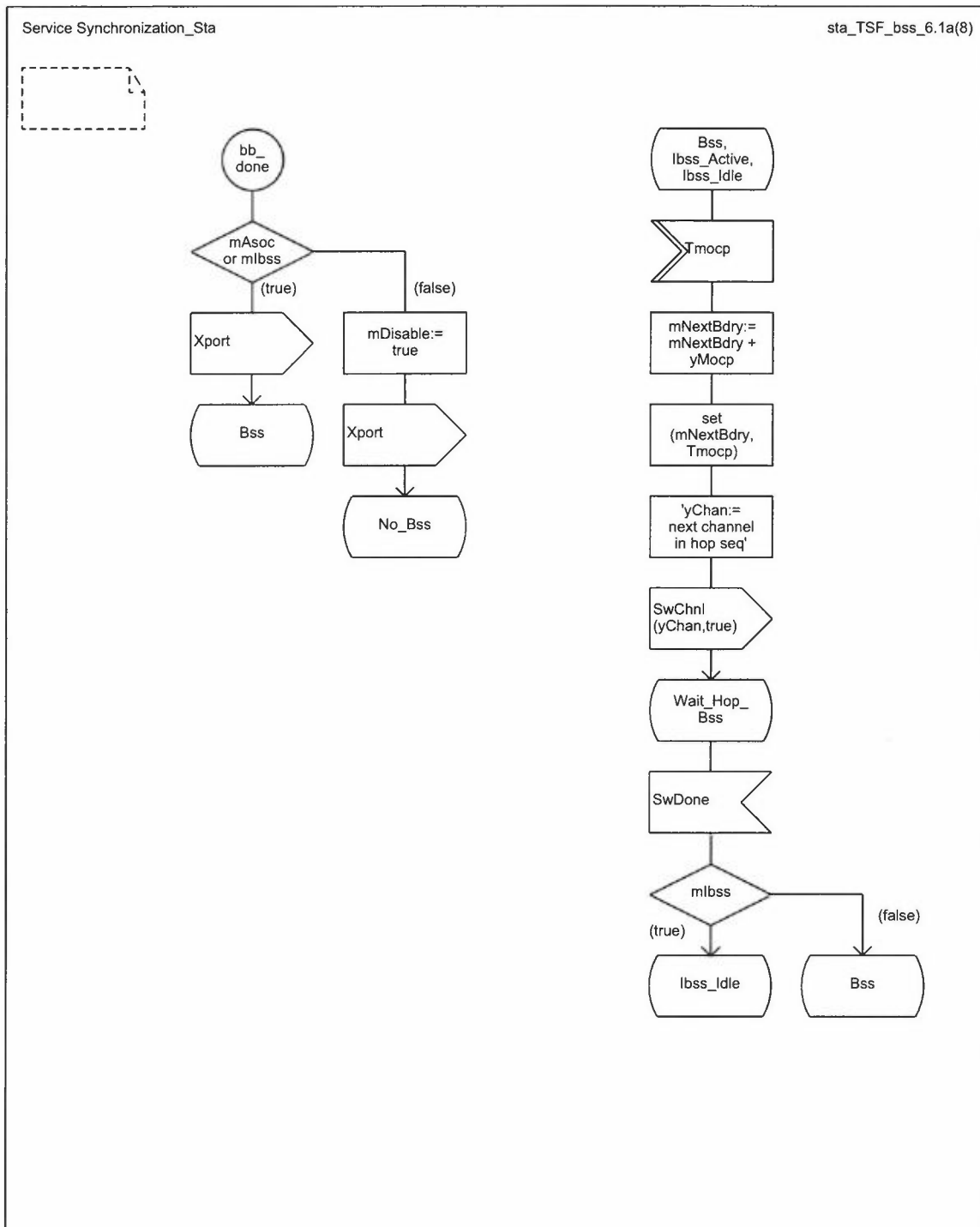


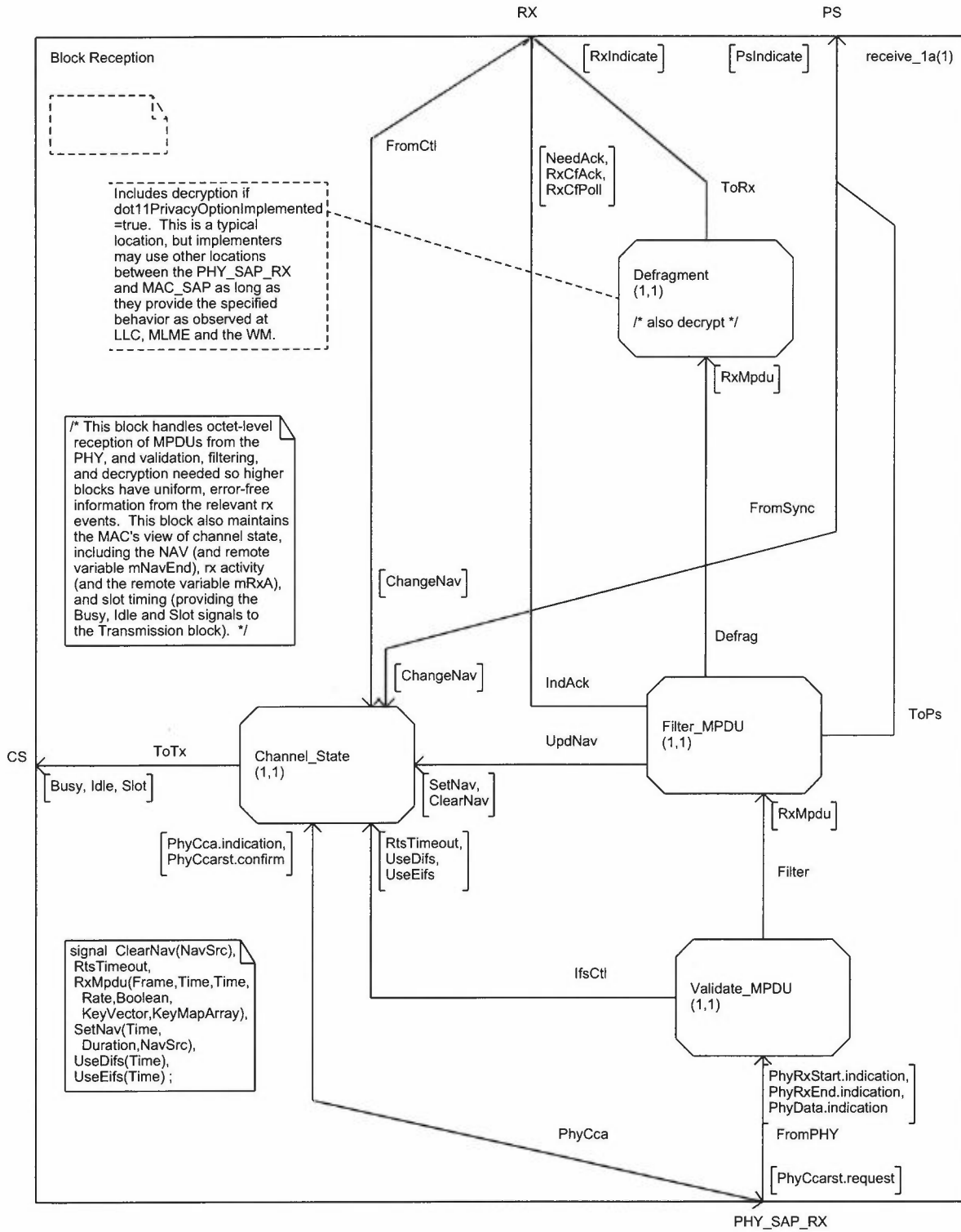


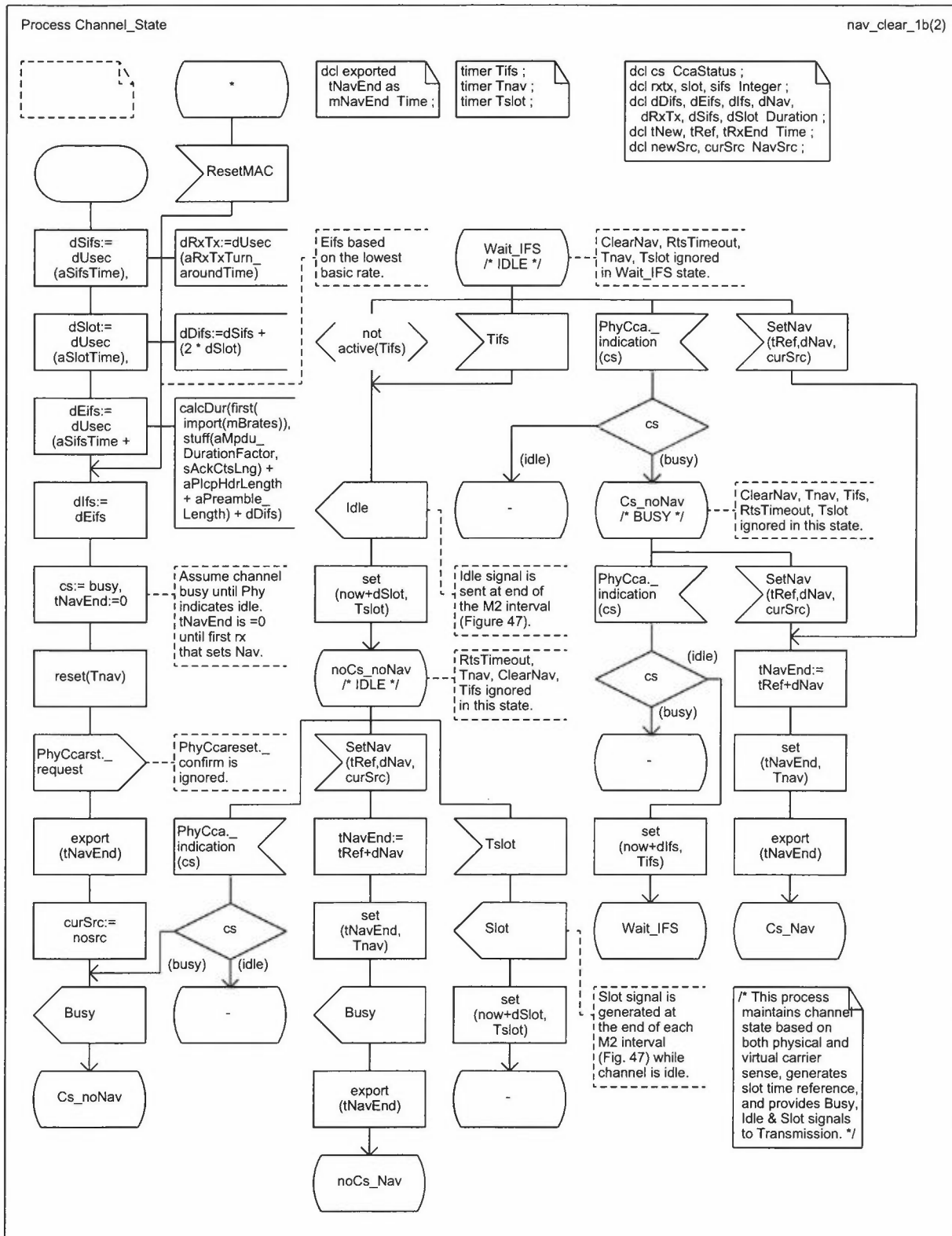


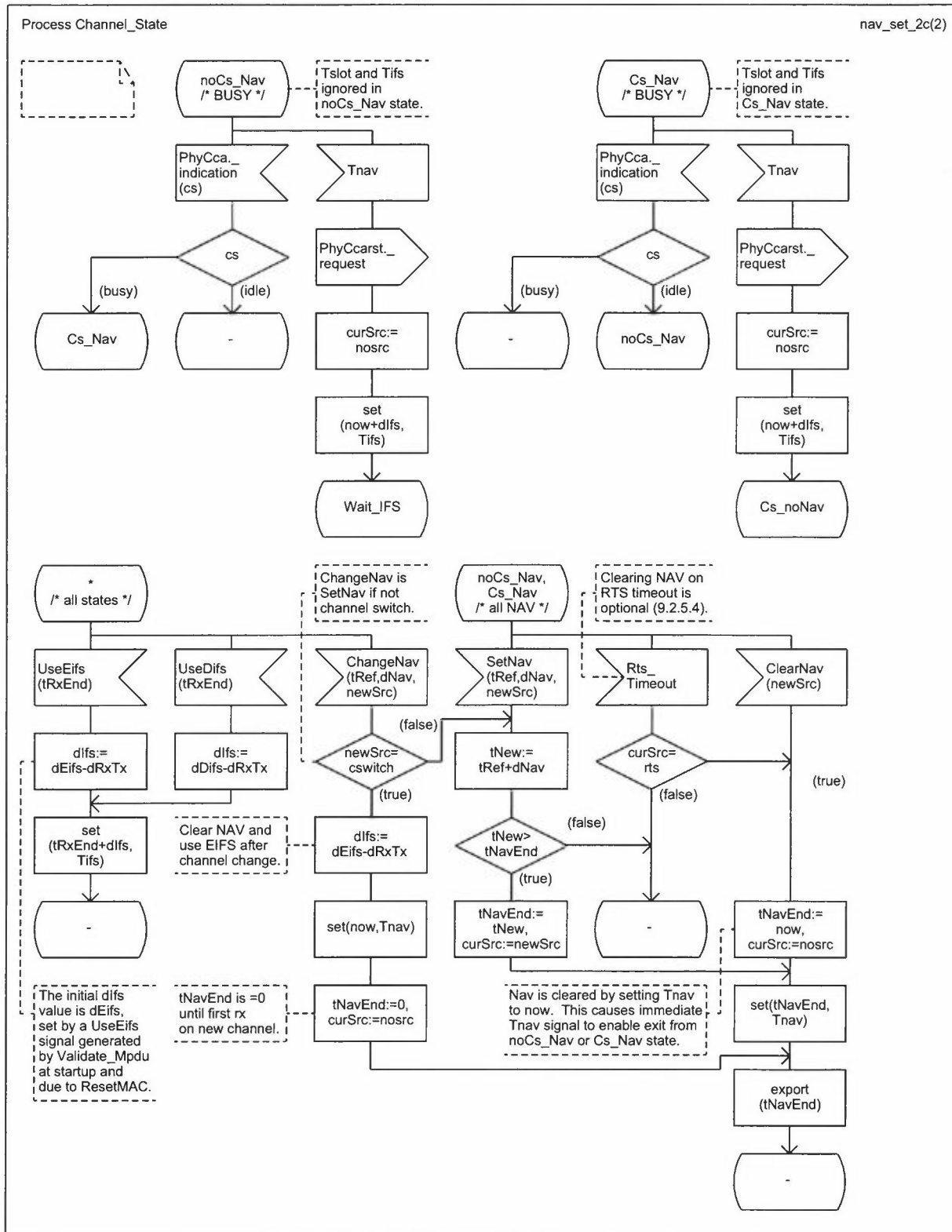


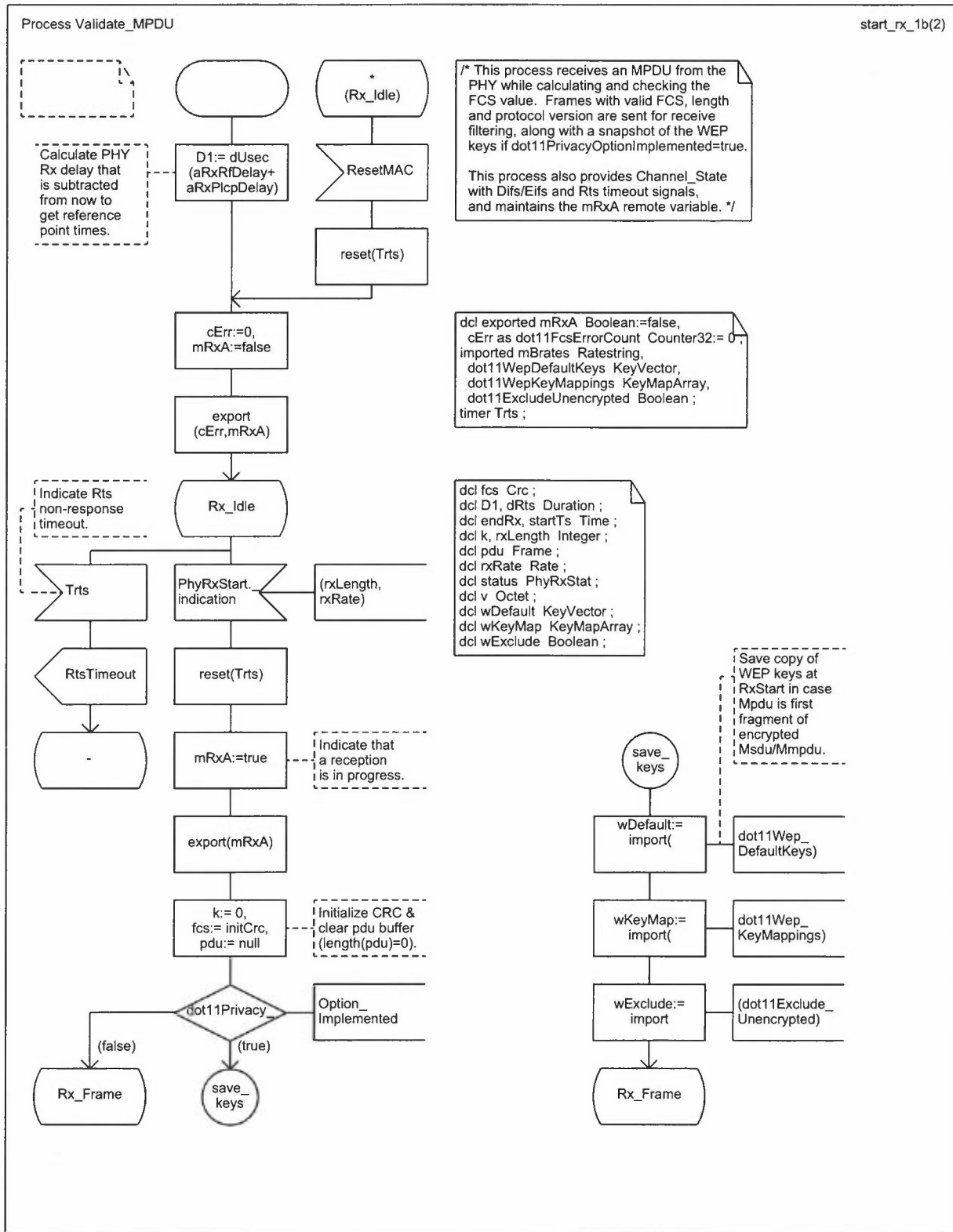


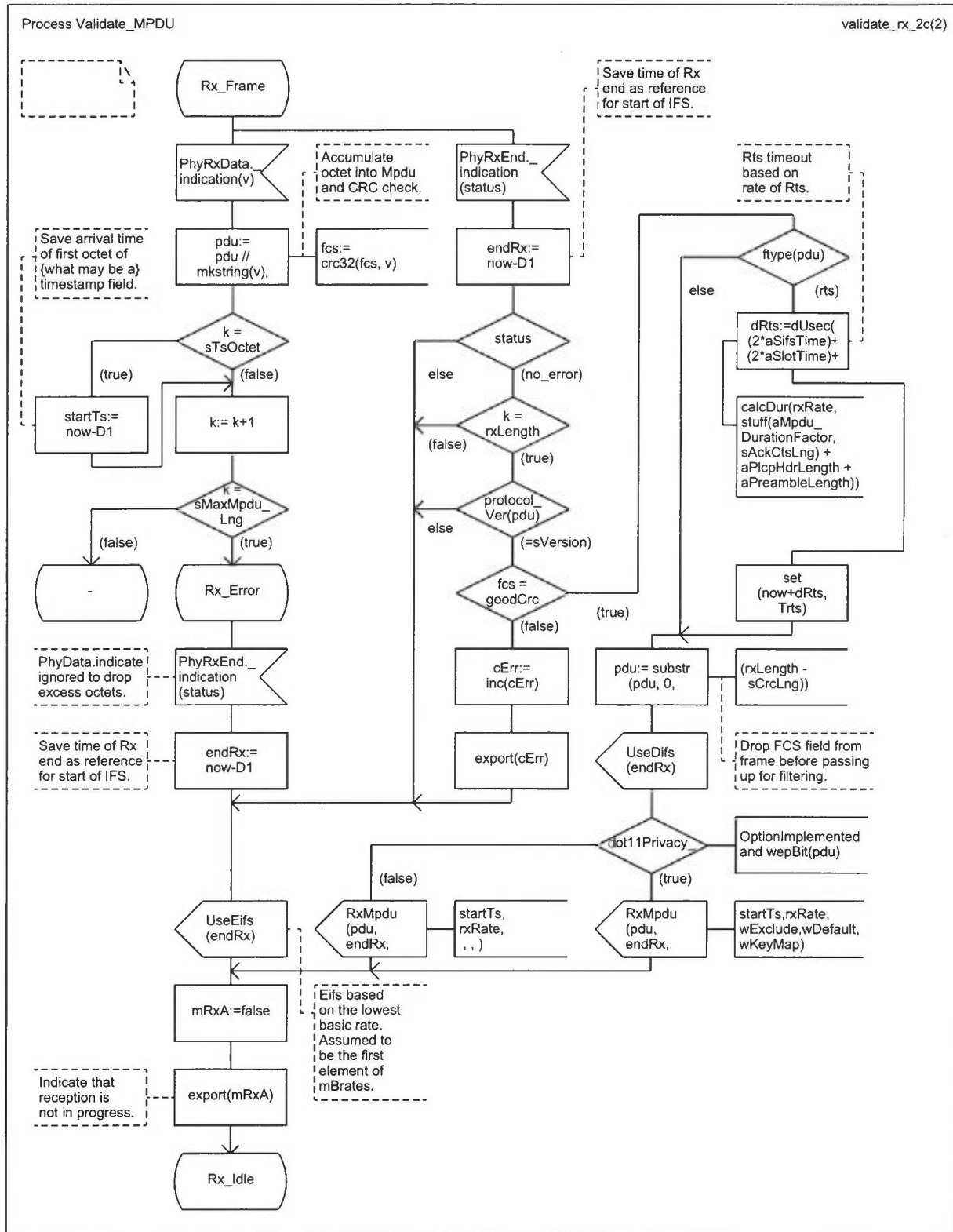


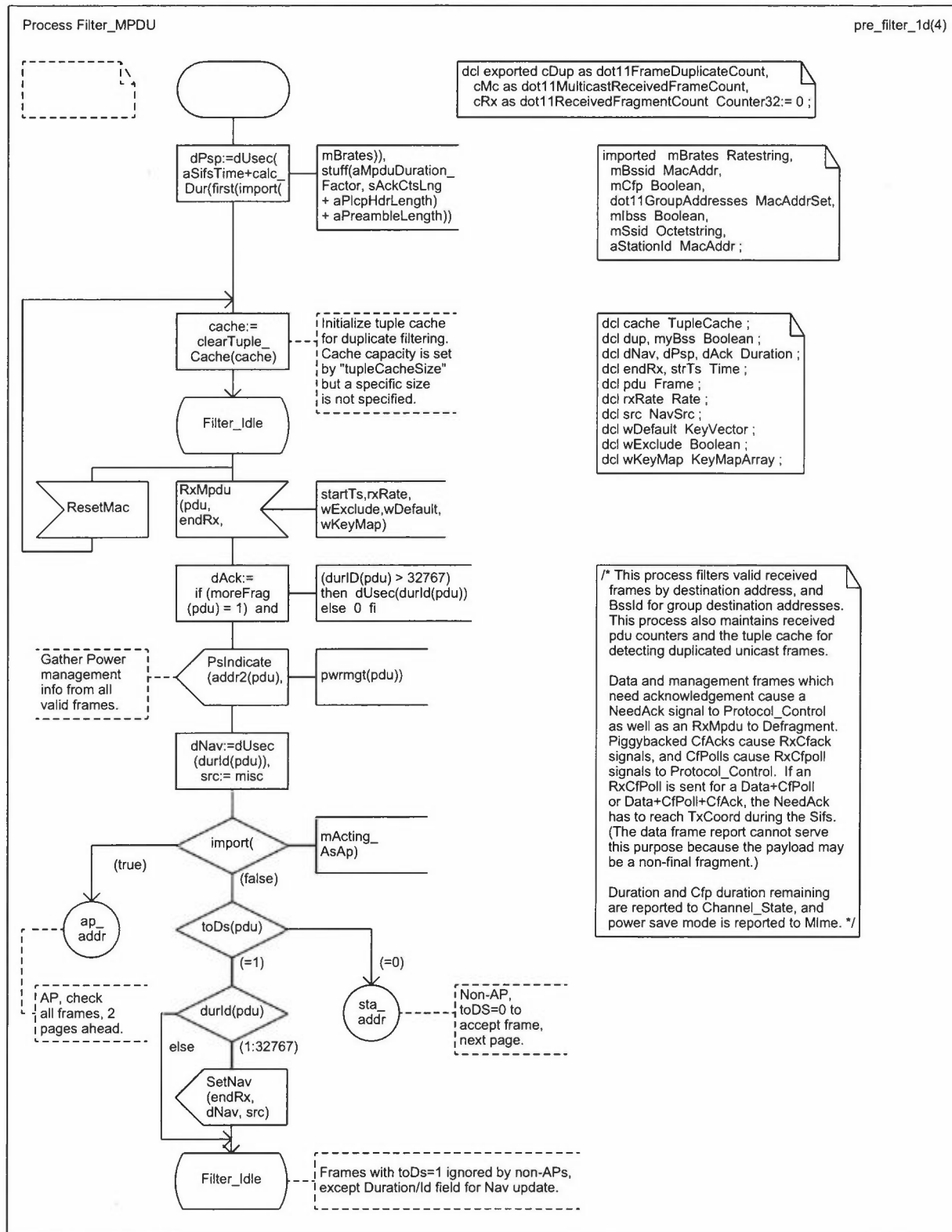


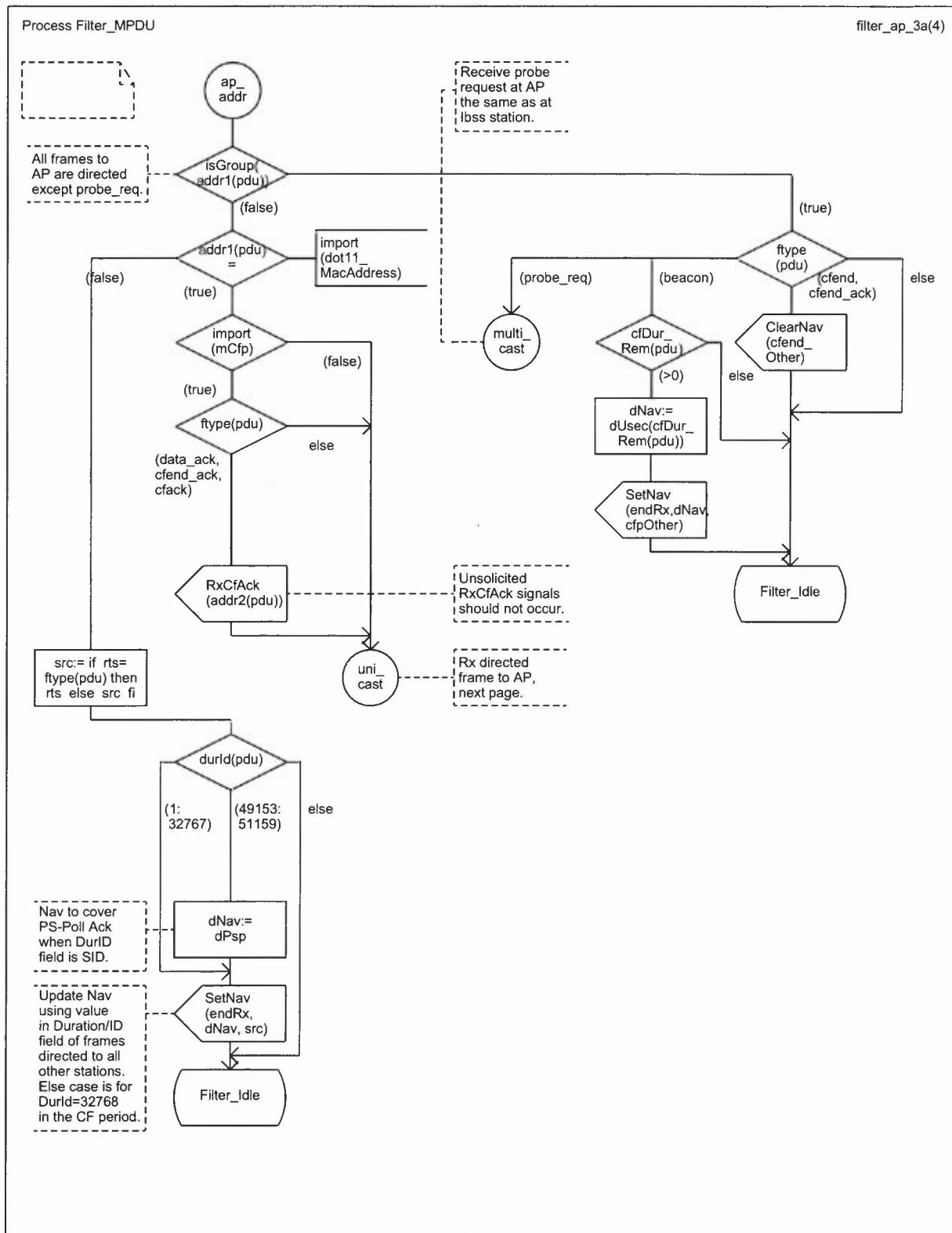


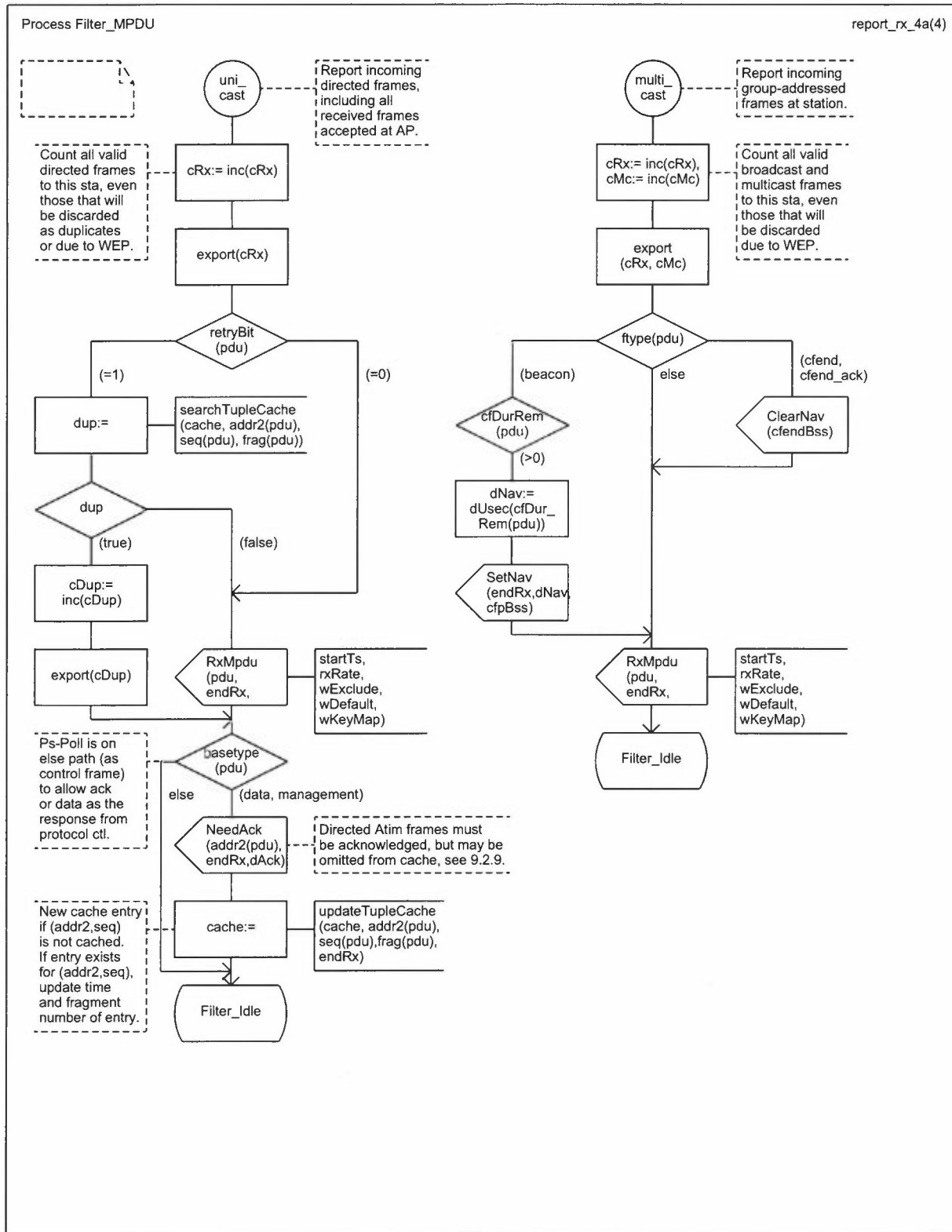


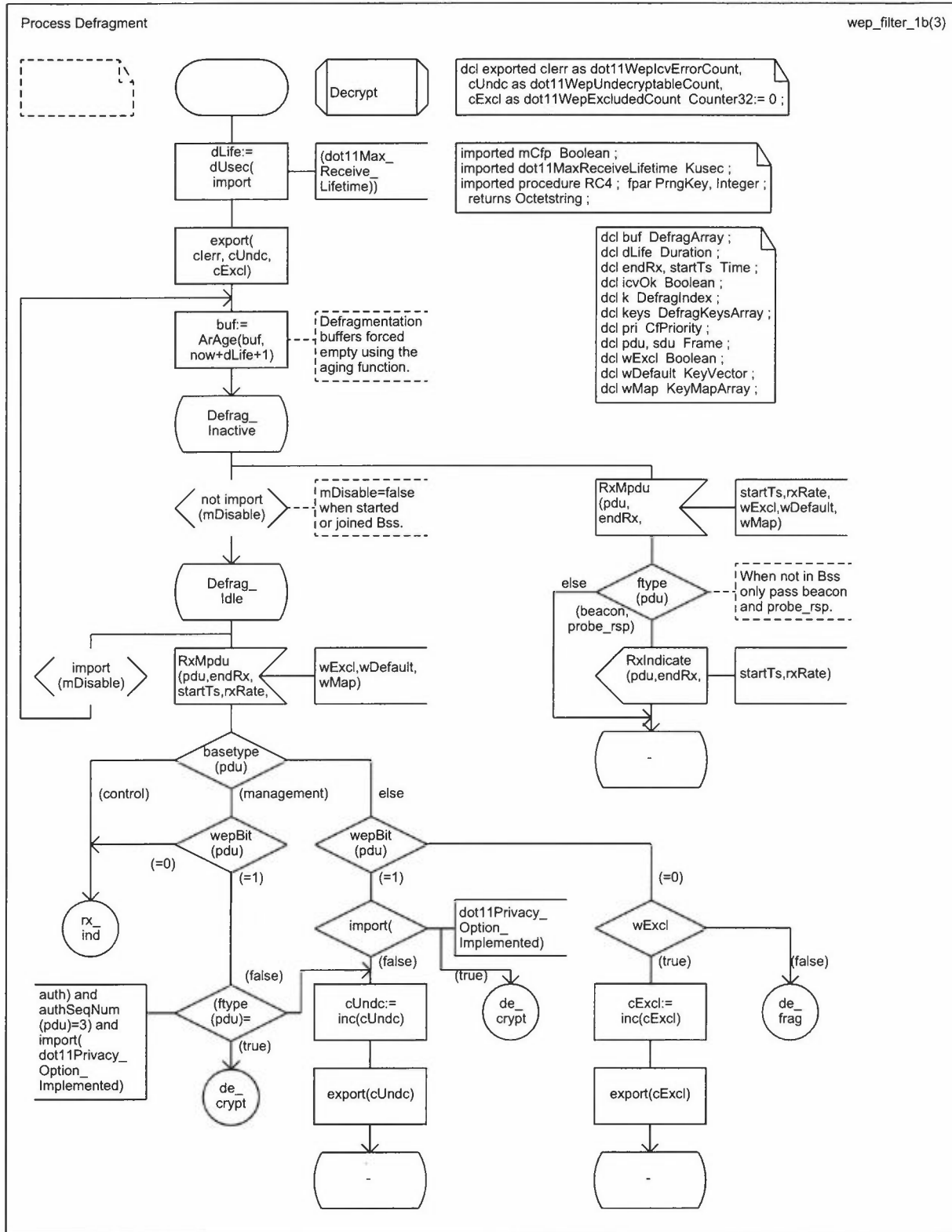


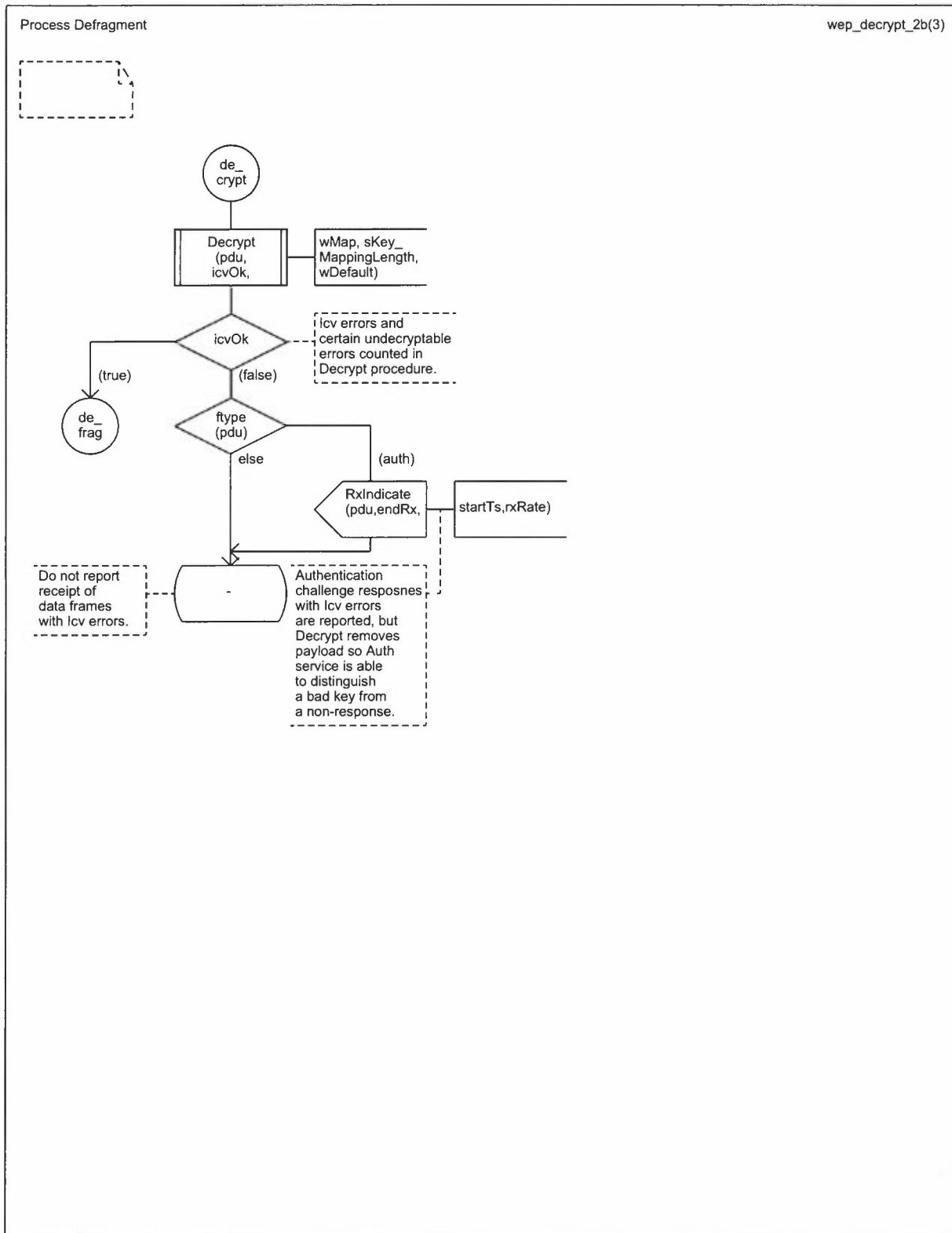


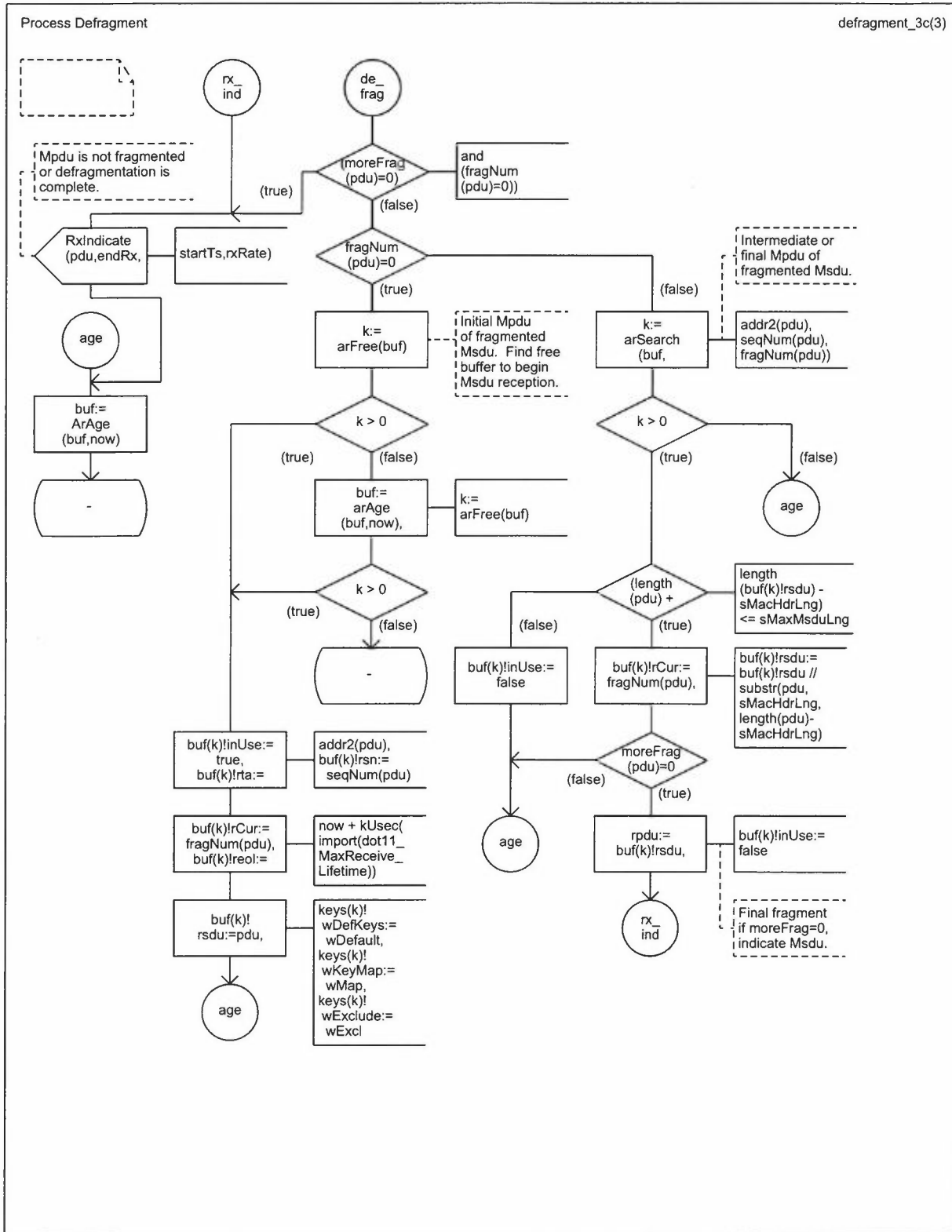


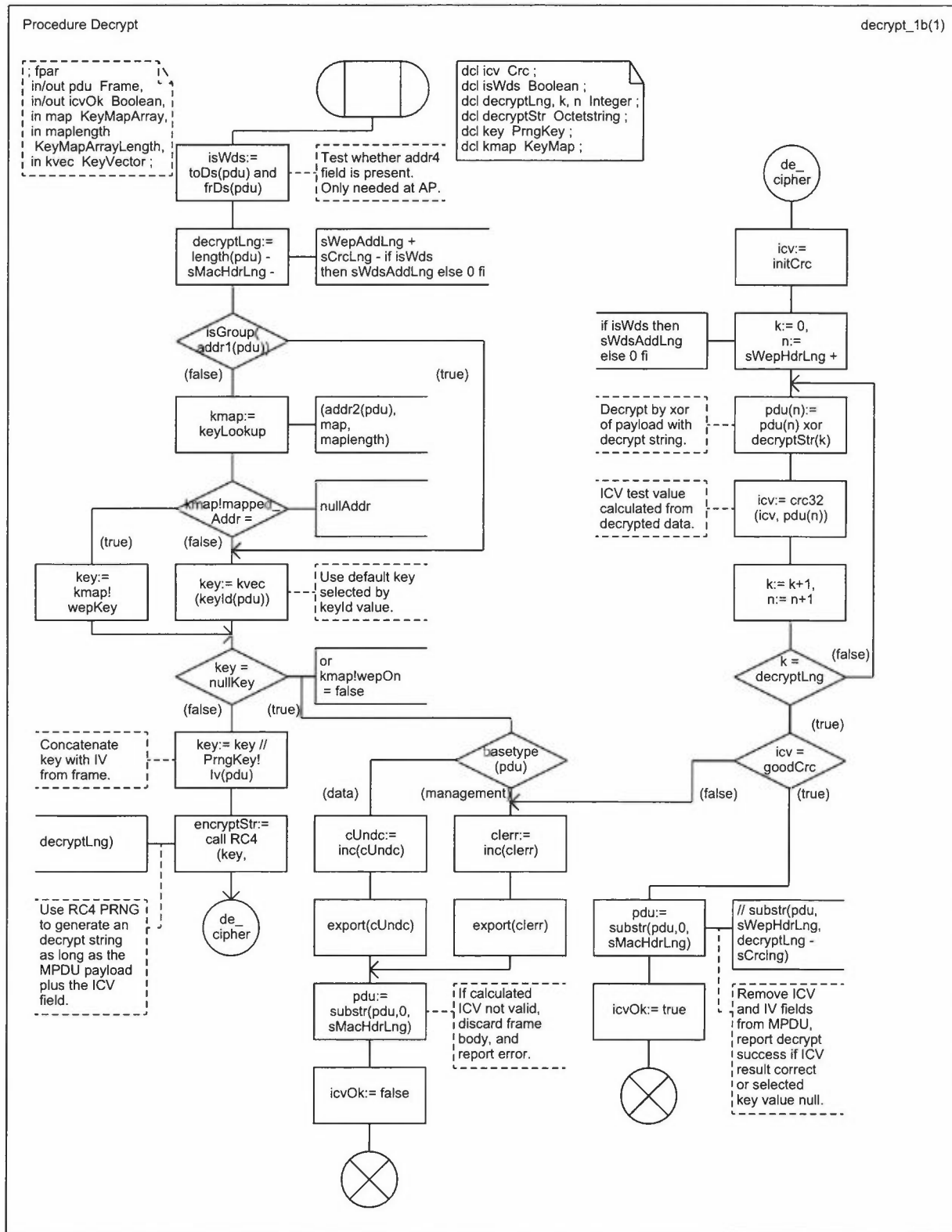












C.4 State machines for MAC access point

The following SDL-92 system specification defines operation of the MAC protocol at an IEEE 802.11 AP. Many aspects of AP operation are identical to the STA operation. These are defined in blocks and processes referenced from both the STA and AP system specifications. Blocks and processes used in both STA and AP are identifiable by the SDL comment `/* for STA & AP */` below the block or process name. Blocks and processes specific to AP operation are identifiable by the SDL comment `/* AP version */` below the block or process name. Definitions for the `/* AP version */` and the `/* STA & AP */` blocks and processes appear in this subclause.

The remainder of this clause is the formal description, in SDL/GR, of an IEEE 802.11 AP.


```
use macsorts ;
use macmib ;
```

System Access_Point

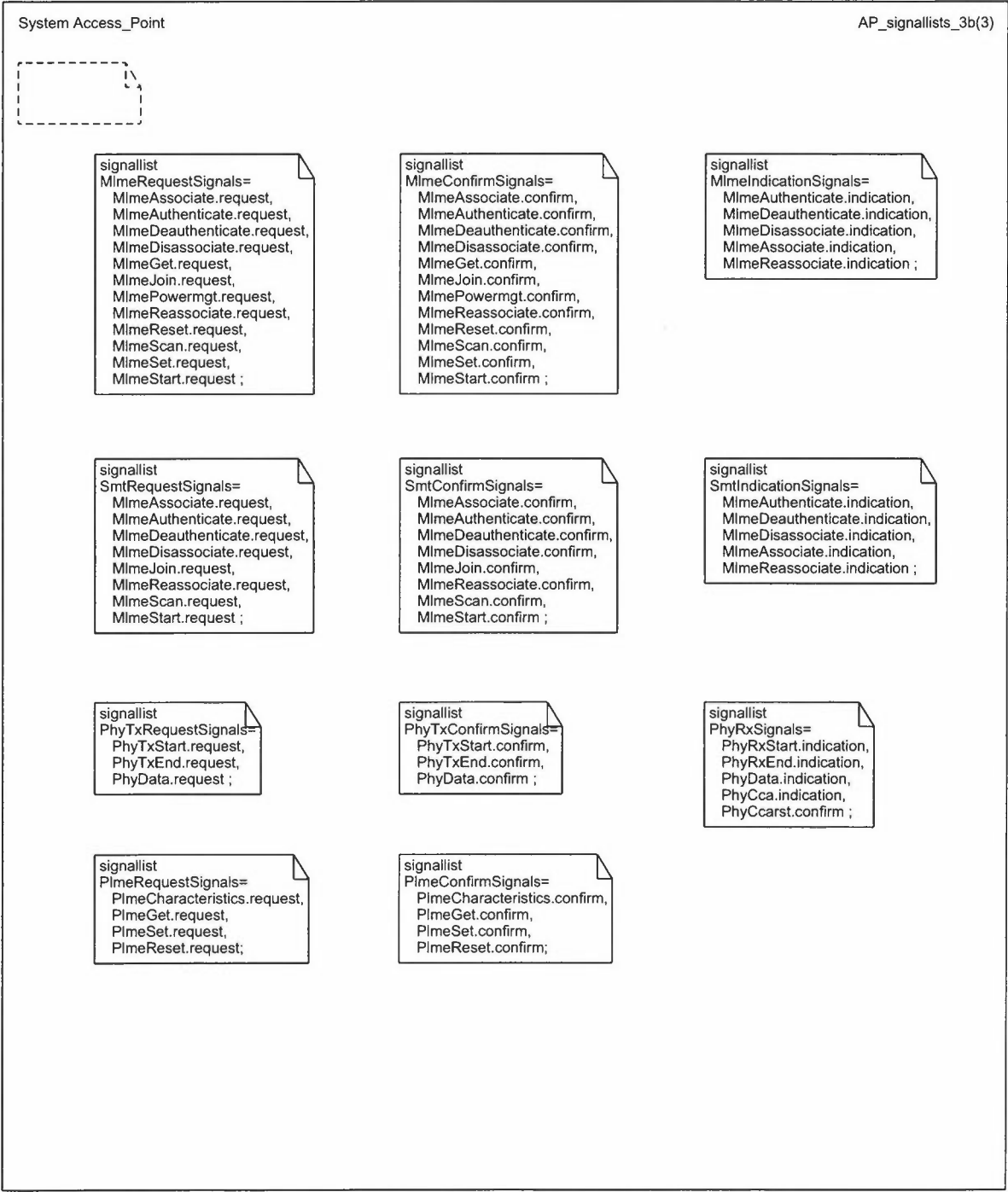
AP_signals_2d(3)

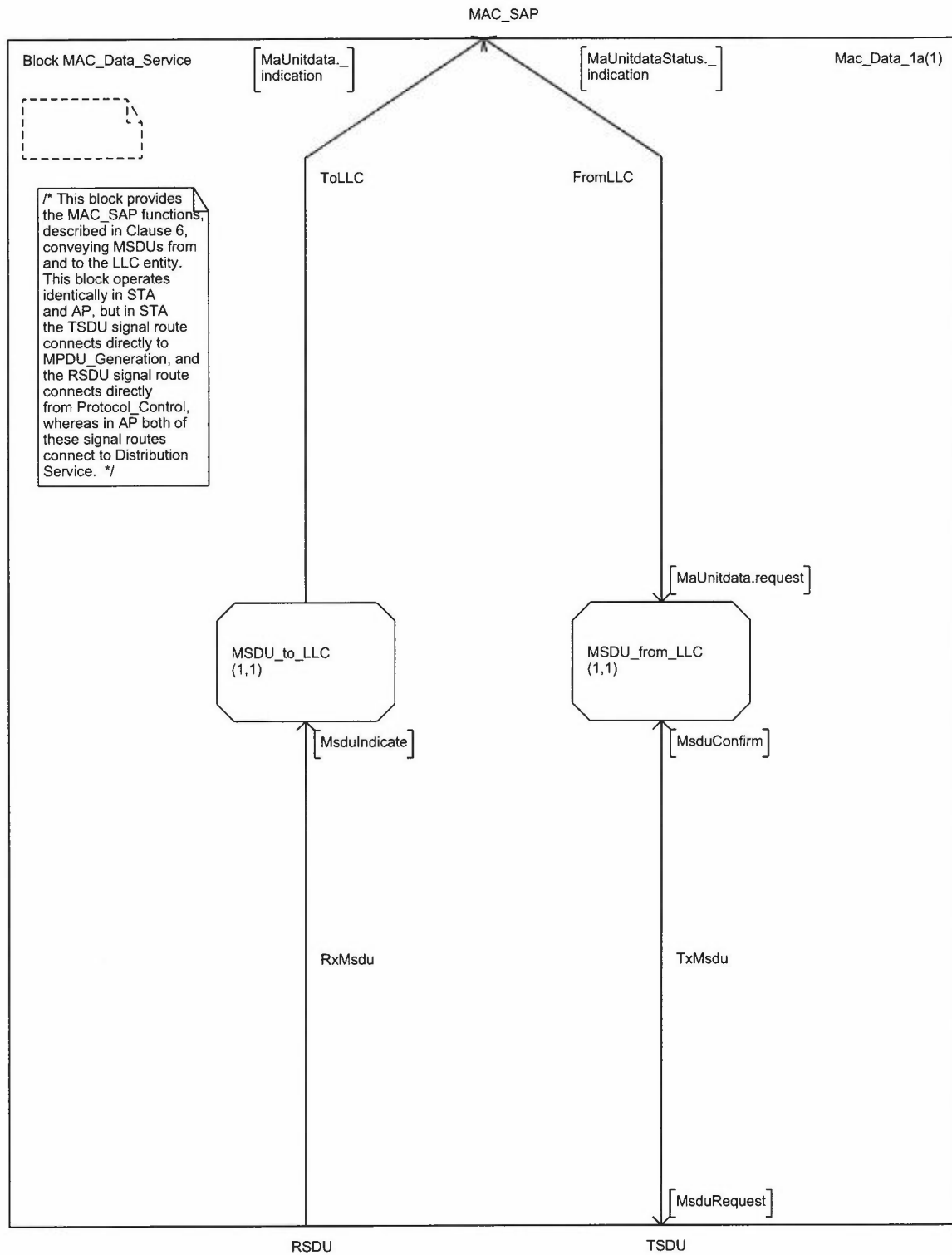
```
newtype DsStatus literals
assoc, disassoc, reassoc, unknown
endnewtype DsStatus ;
```

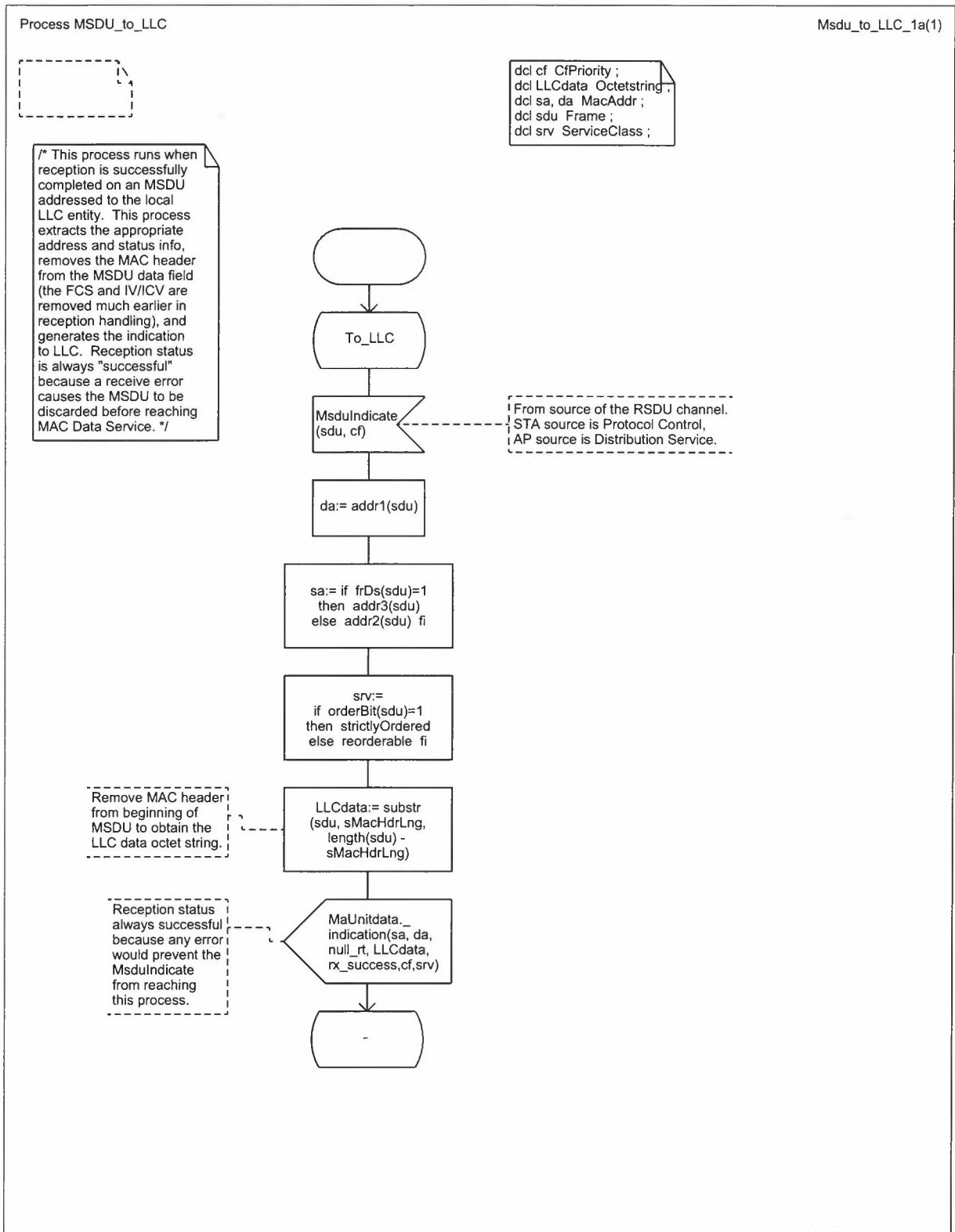
```
signal
AsChange(Frame,DsStatus),
Backoff(Integer,Integer),
BkDone(Integer),
Busy,
Cancel,
ChangeNav(Time,Duration,NavSrc),
DsInquiry(MacAddr,MacAddr),
DsNotify(MacAddr,DsStatus),
DsResponse(MacAddr,MacAddr,DsStatus),
FromDsm(MacAddr,MacAddr,Octetstring),
Idle,
MaUnitdata.indication(MacAddr,MacAddr,
Routing,Octetstring,RxStatus,
CfPriority,ServiceClass),
MaUnitdata.request(MacAddr,MacAddr,
Routing,Octetstring,CfPriority,ServiceClass),
MaUnitdataStatus.indication(MacAddr,
MacAddr,TxStatus,CfPriority,ServiceClass),
MlmeAssociate.confirm(MlmeStatus),
MlmeAssociate.indication(MacAddr),
MlmeAssociate.request(MacAddr,Kusec,Capability,Integer),
MlmeAuthenticate.confirm
(MacAddr,AuthType,MlmeStatus),
MlmeAuthenticate.indication(MacAddr,AuthType),
MlmeAuthenticate.request(MacAddr,AuthType,Kusec),
MlmeDeauthenticate.confirm(MacAddr,MlmeStatus),
MlmeDeauthenticate.indication(MacAddr,ReasonCode),
MlmeDeauthenticate.request(MacAddr,ReasonCode),
MlmeDisassociate.confirm(MlmeStatus),
MlmeDisassociate.indication(MacAddr,ReasonCode),
MlmeDisassociate.request(MacAddr,ReasonCode),
MlmeGet.confirm(MibStatus,MibAtrib,MibValue),
MlmeGet.request(MibAtrib),
MlmeJoin.confirm(MlmeStatus),
MlmeJoin.request(BssDscr,Integer,Usec,Ratestring),
MlmePowermgt.confirm(MlmeStatus),
MlmePowermgt.request(PwrSave,Boolean,Boolean),
MlmeReassociate.confirm(MlmeStatus),
MlmeReassociate.indication(MacAddr),
MlmeReassociate.request(MacAddr,Kusec,Capability,Integer),
MlmeReset.confirm(MlmeStatus),
MlmeReset.request,
MlmeScan.confirm(BssDscrSet,MlmeStatus),
MlmeScan.request(BssTypeSet,MacAddr,Octetstring,
ScanType,Usec,Intstring,Kusec,Kusec),
MlmeSet.confirm(MibStatus,MibAtrib),
MlmeSet.request(MibAtrib,MibValue),
MlmeStart.confirm(MlmeStatus),
MlmeStart.request(Octetstring,BssType,Kusec,
Integer,CfParms,PhyParms,lbssParms,Usec,
Capability,Ratestring,Ratestring) ;
```

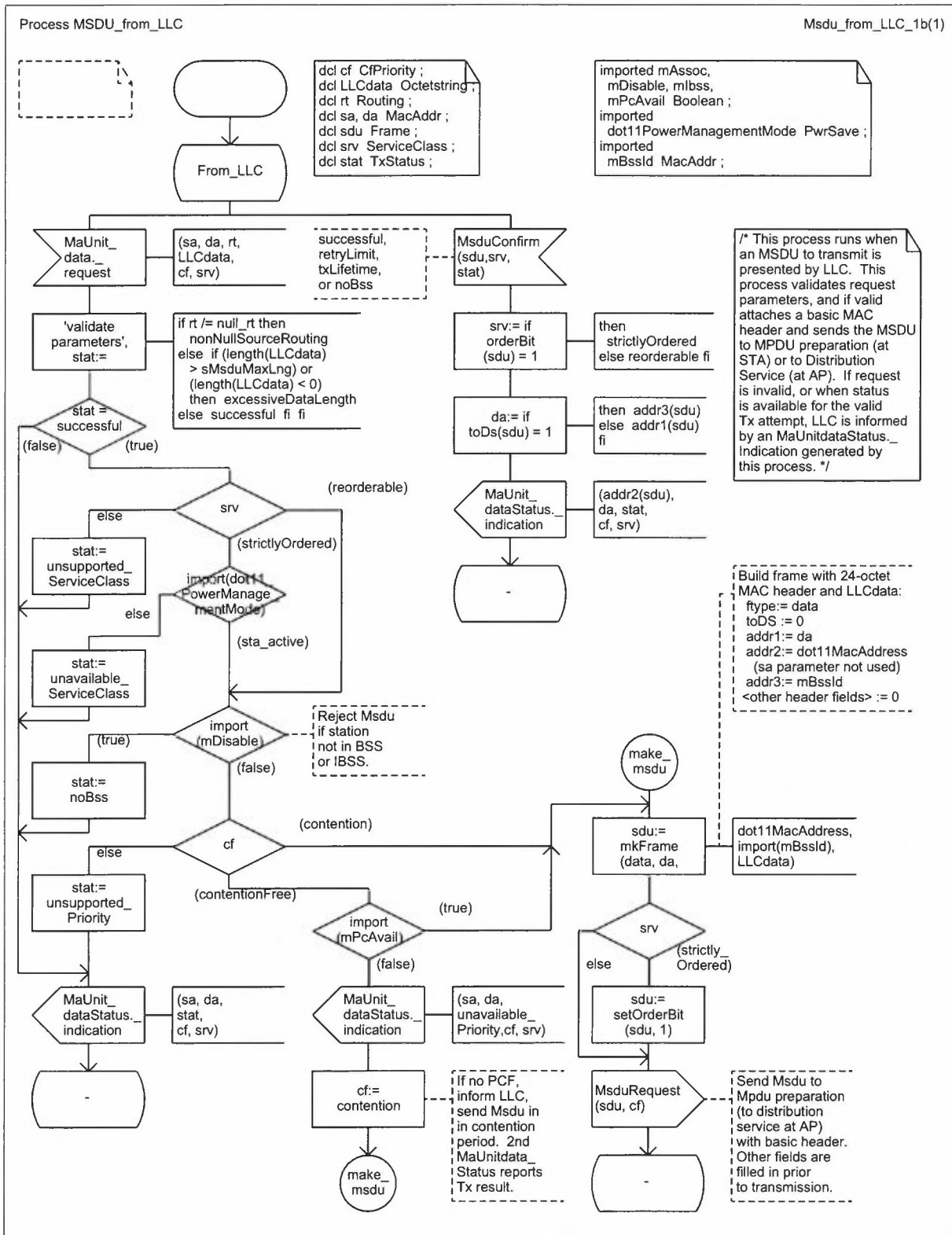
```
signal
MmCancel,
MmConfirm(Frame,TxStatus),
MmIndicate(Frame,Time,Time,StateErr),
MmRequest(Frame,Imed,Rate),
MsduConfirm(Frame,CfPriority,TxStatus),
MsduIndicate(Frame,CfPriority),
MsduRequest(Frame,CfPriority),
NeedAck(MacAddr,Time,Duration,Rate),
PduConfirm(FragSdu,TxResult),
PduRequest(FragSdu),
PhyCca.indication(Ccastatus),
PhyCcarst.confirm,
PhyCcarst.request,
PhyData.confirm,
PhyData.indication(Octet),
PhyData.request(Octet),
PhyRxEnd.indication(PhyRxStat),
PhyRxStart.indication(Integer,Rate),
PhyTxEnd.confirm,
PhyTxEnd.request,
PhyTxStart.confirm,
PhyTxStart.request(Integer,Rate),
PlmeCharacteristics.confirm(PhyChrctcs),
PlmeCharacteristics.request,
PlmeGet.confirm(MibStatus,
MibAtrib,MibValue),
PlmeGet.request(MibAtrib),
PlmeReset.confirm(Boolean),
PlmeReset.request,
PlmeSet.confirm(MibStatus,MibAtrib),
PlmeSet.request(MibAtrib,MibValue),
PsmDone,
PsPolled(MacAddr,AsocId),
PsChange(MacAddr,PsMode),
PsIndicate(MacAddr,PsMode),
PsInquiry(MacAddr),
PsResponse(MacAddr,PsMode),
ResetMAC,
RxCfAck(MacAddr),
RxIndicate(Frame,Time,Time,Rate),
Slot,
SsInquiry(MacAddr),
SsResponse(MacAddr,
StationState,StationState),
SwChnl(Integer,Boolean),
SwDone,
ToDsm(MacAddr,MacAddr,Octetstring),
TxConfirm,
TxRequest(Frame,Rate) ;
```

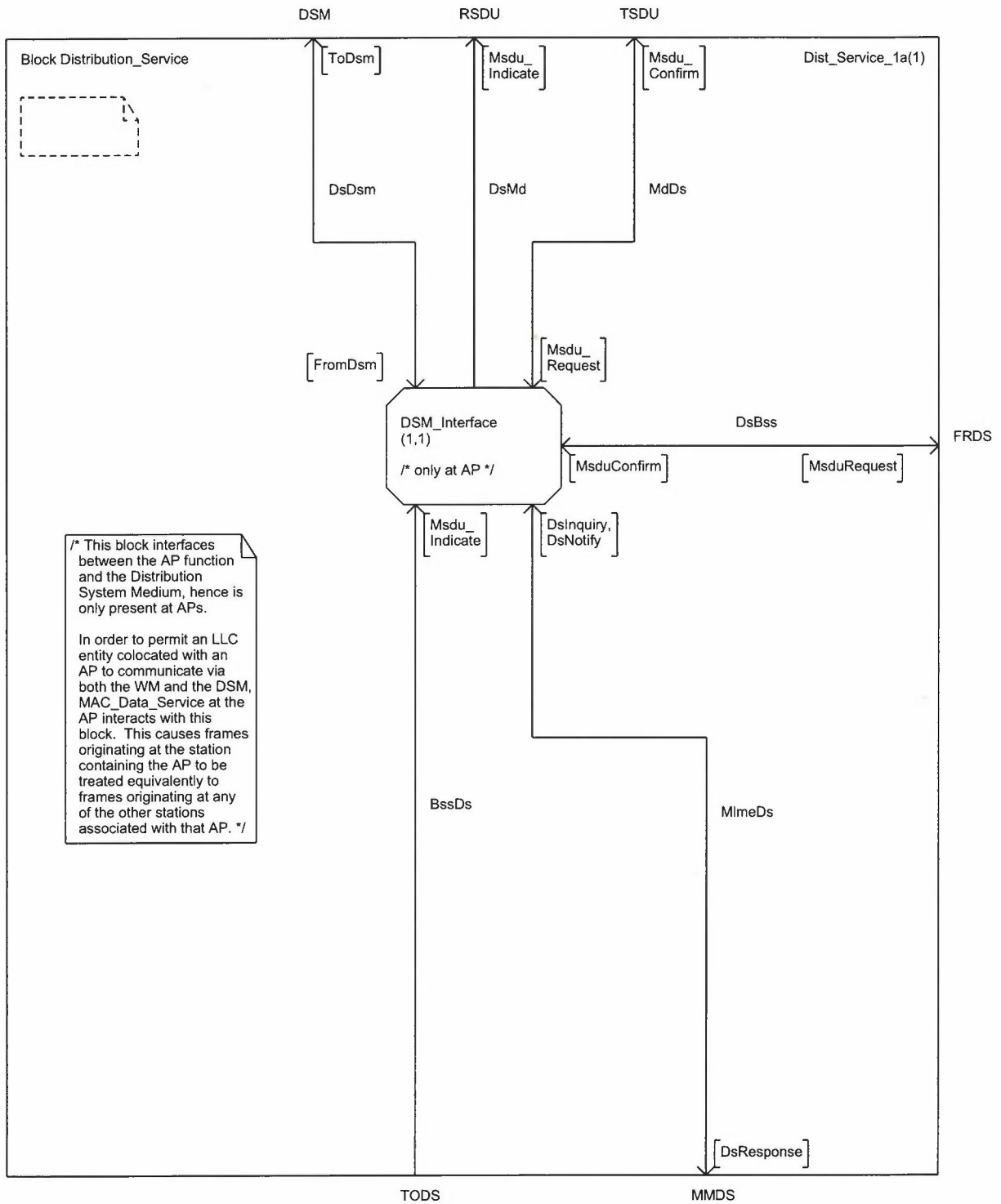
```
use macsorts ;
use macmib ;
```

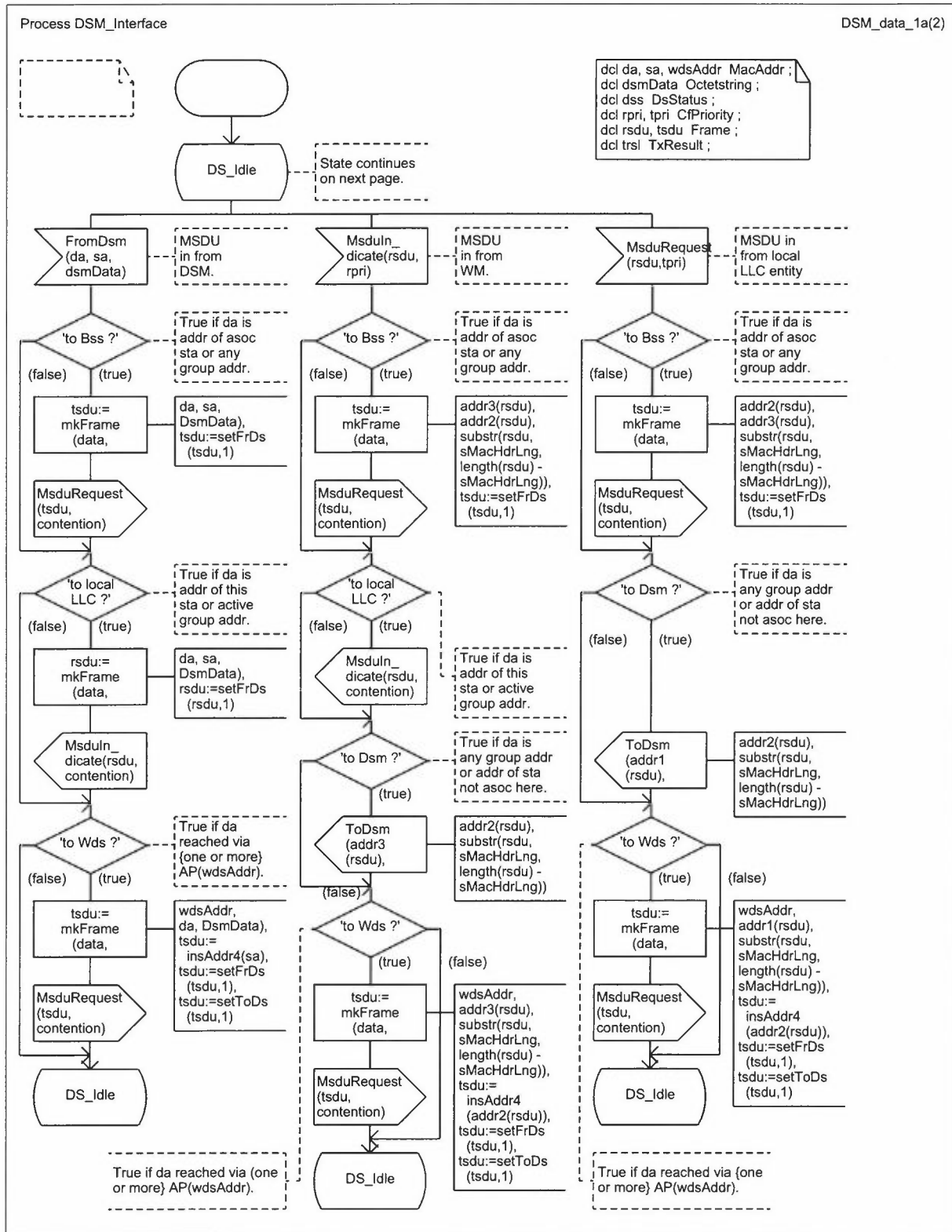


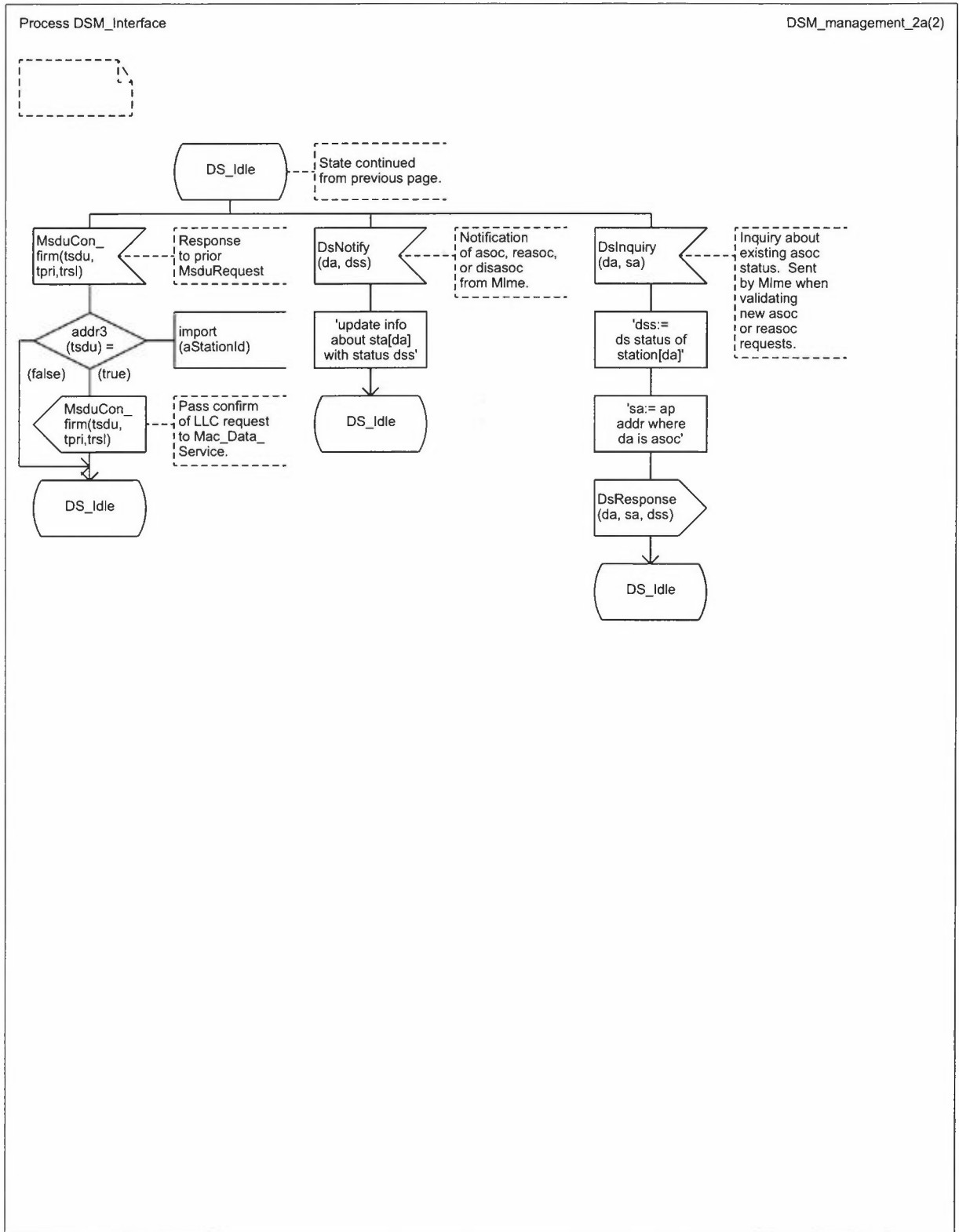


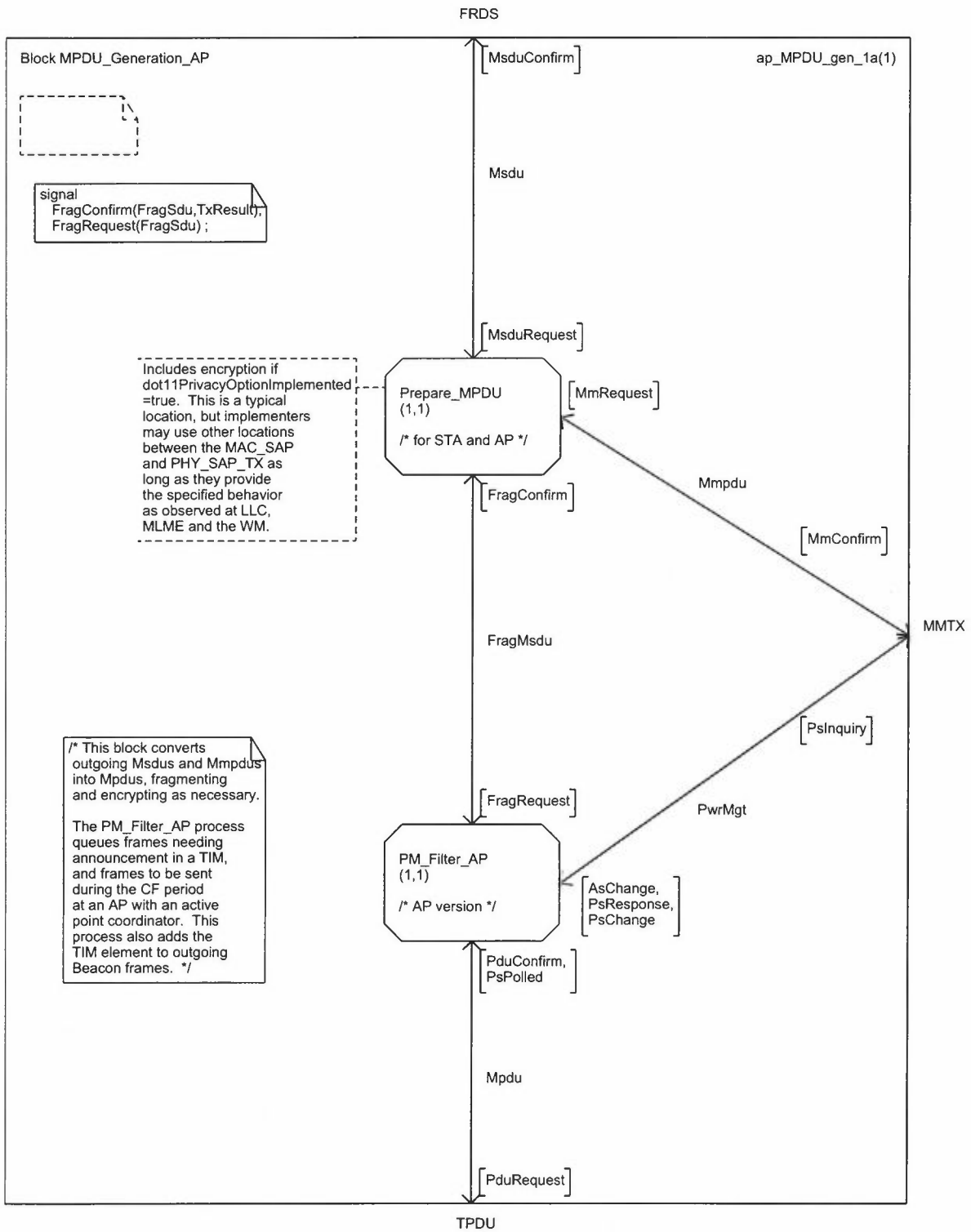


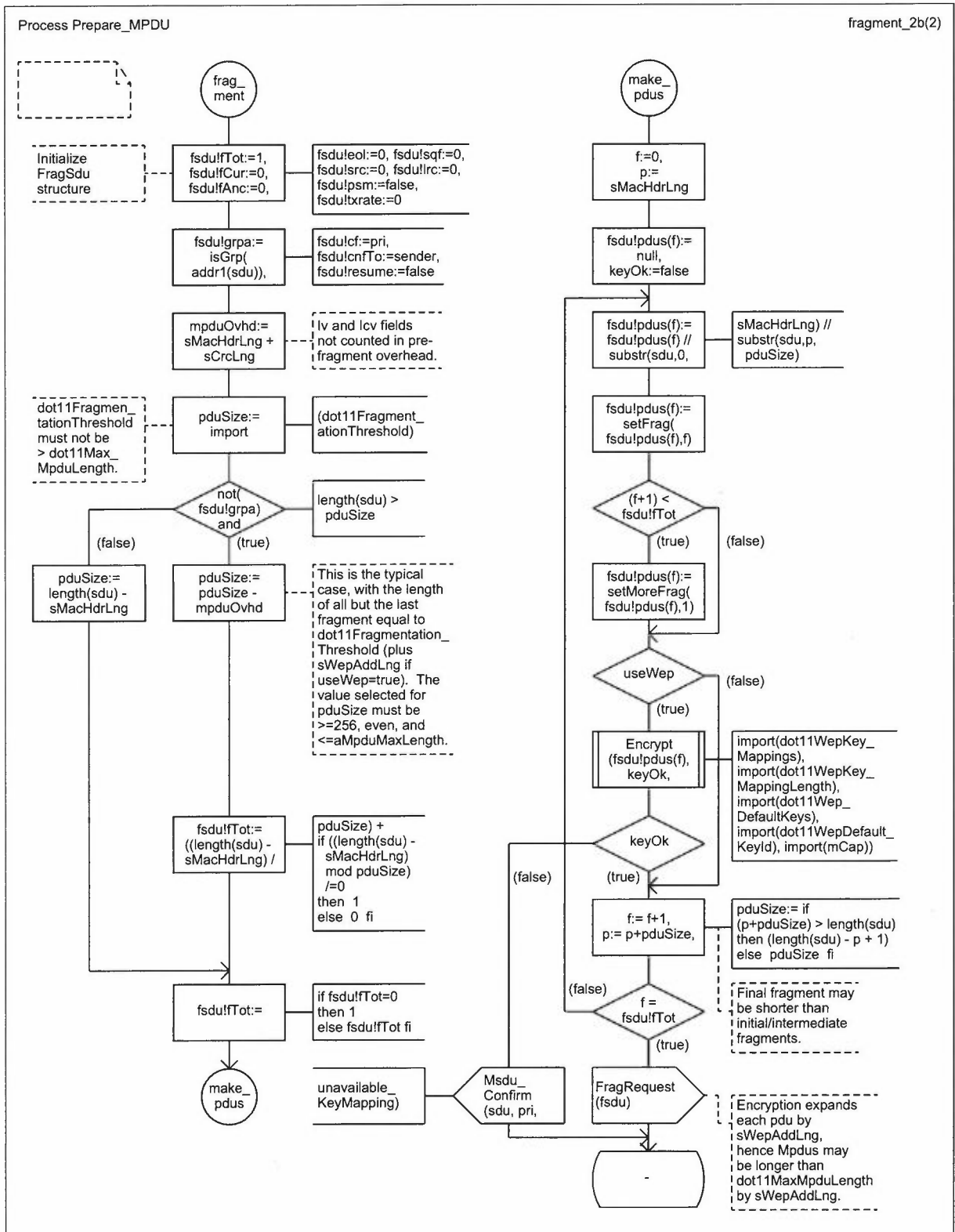


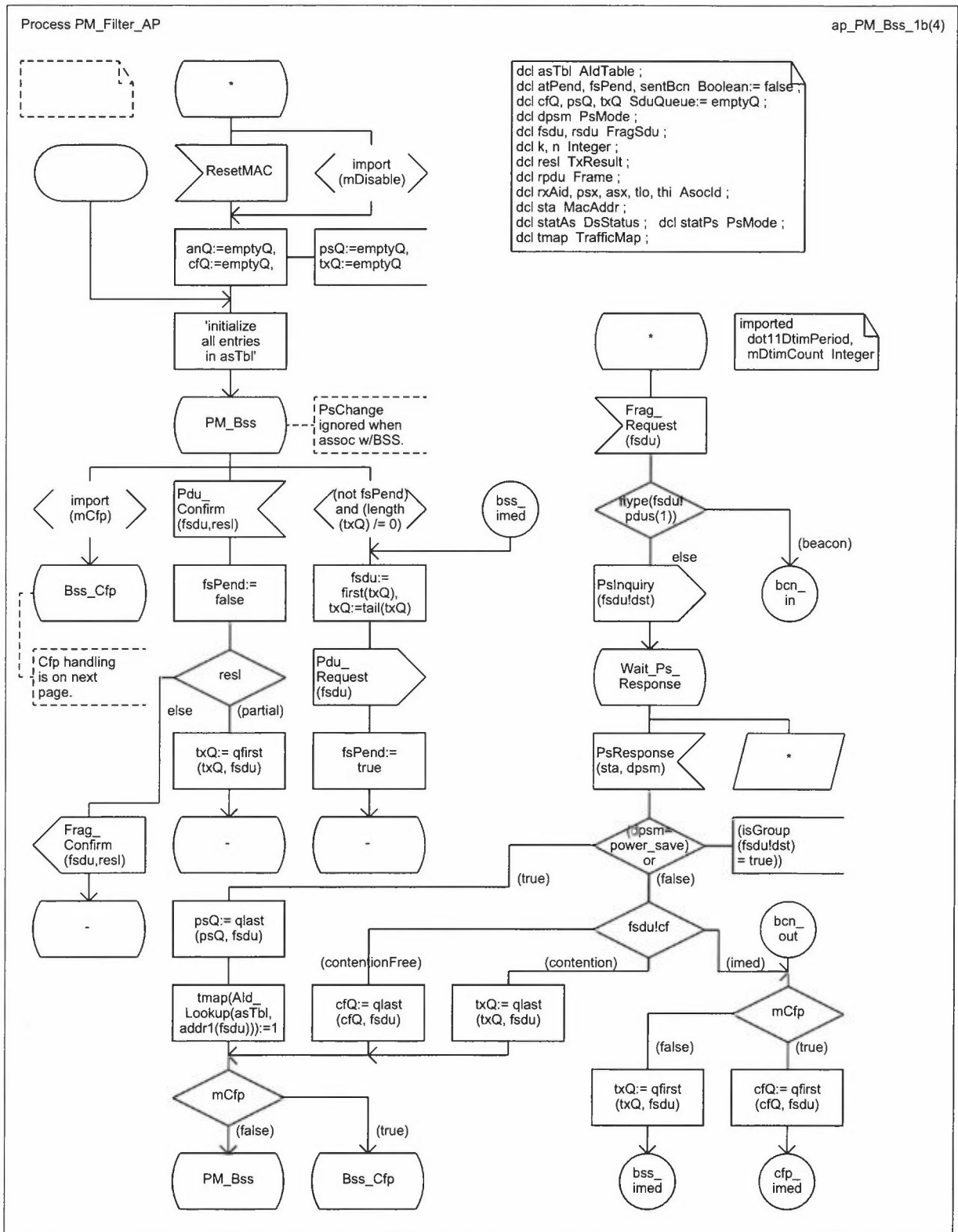






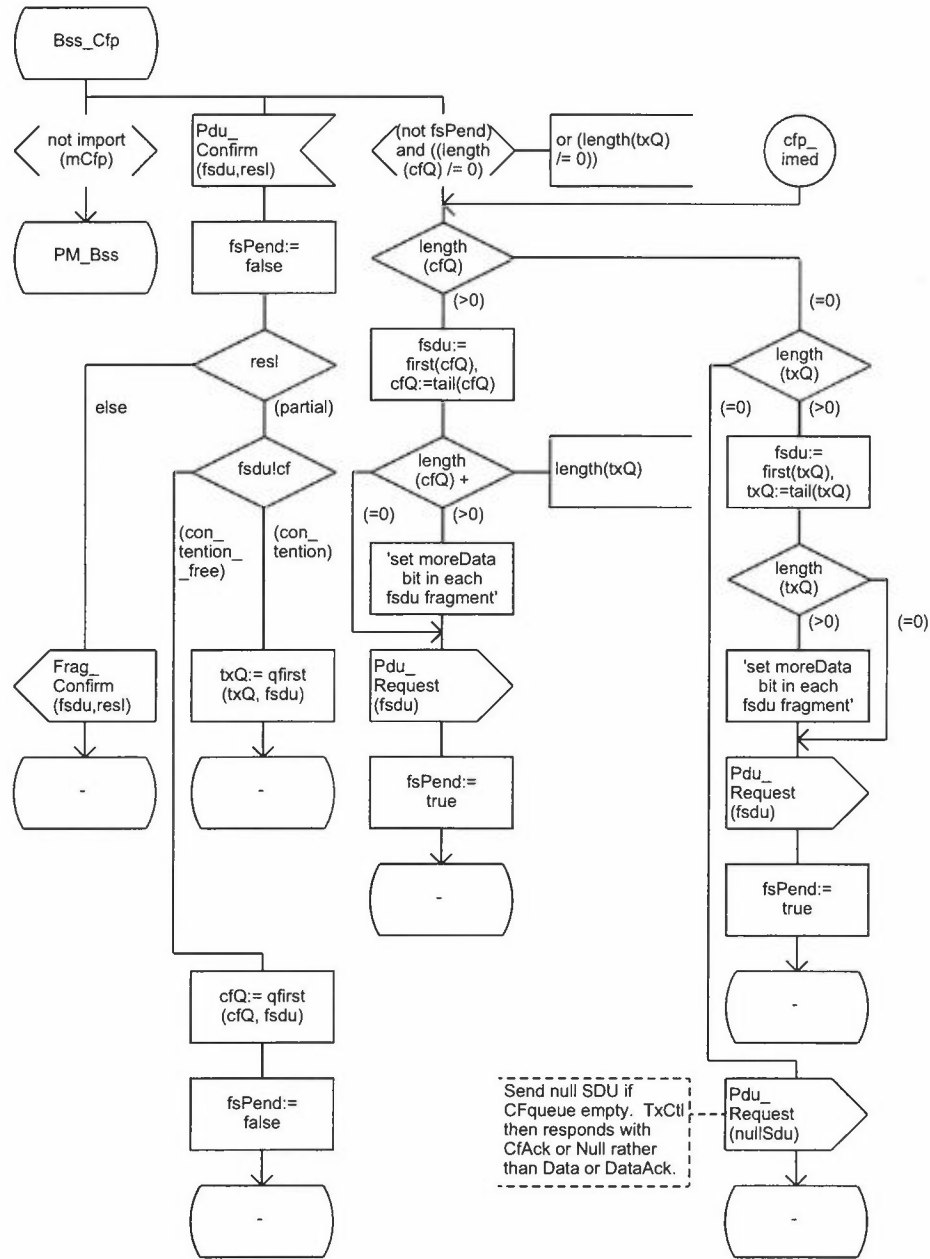


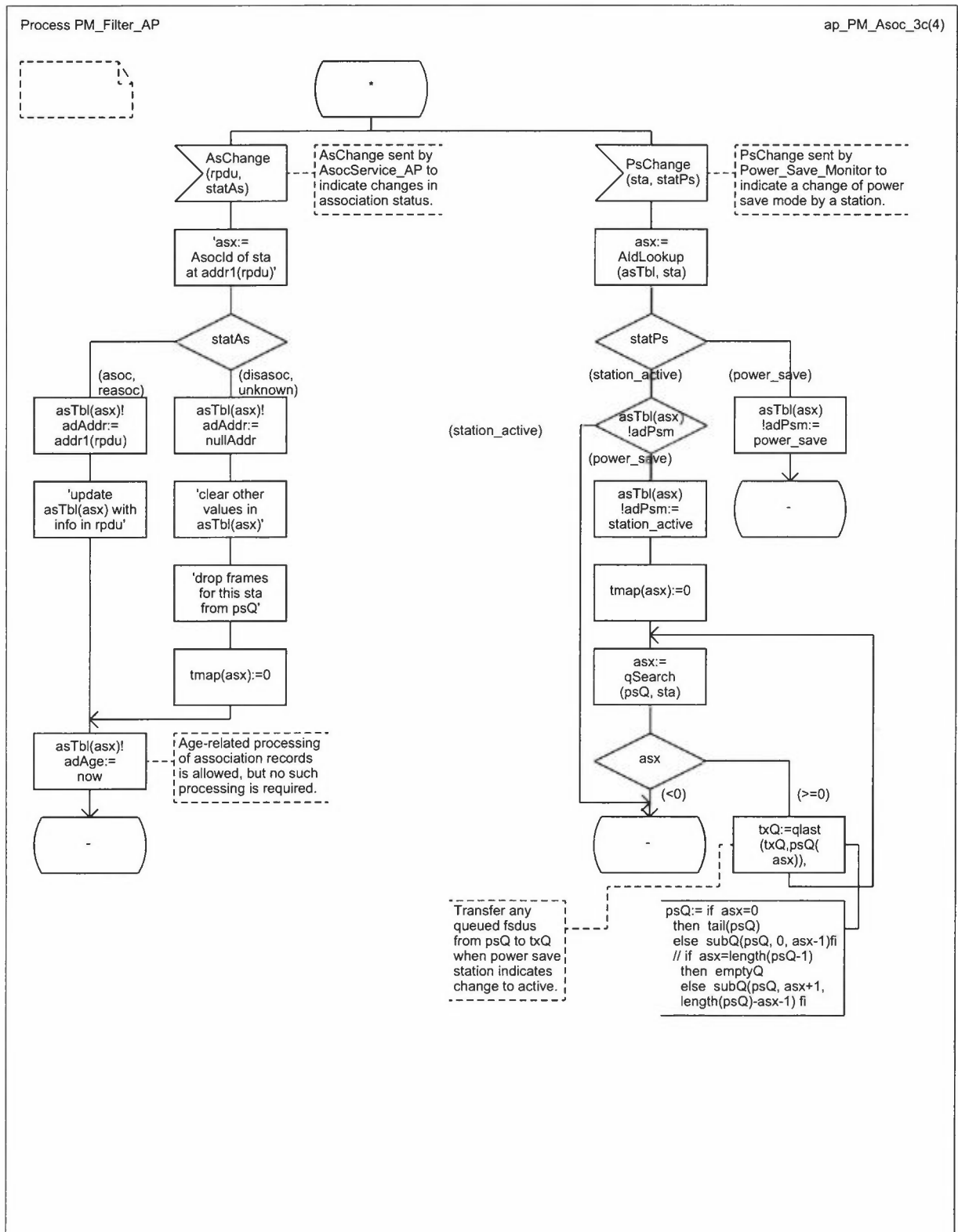


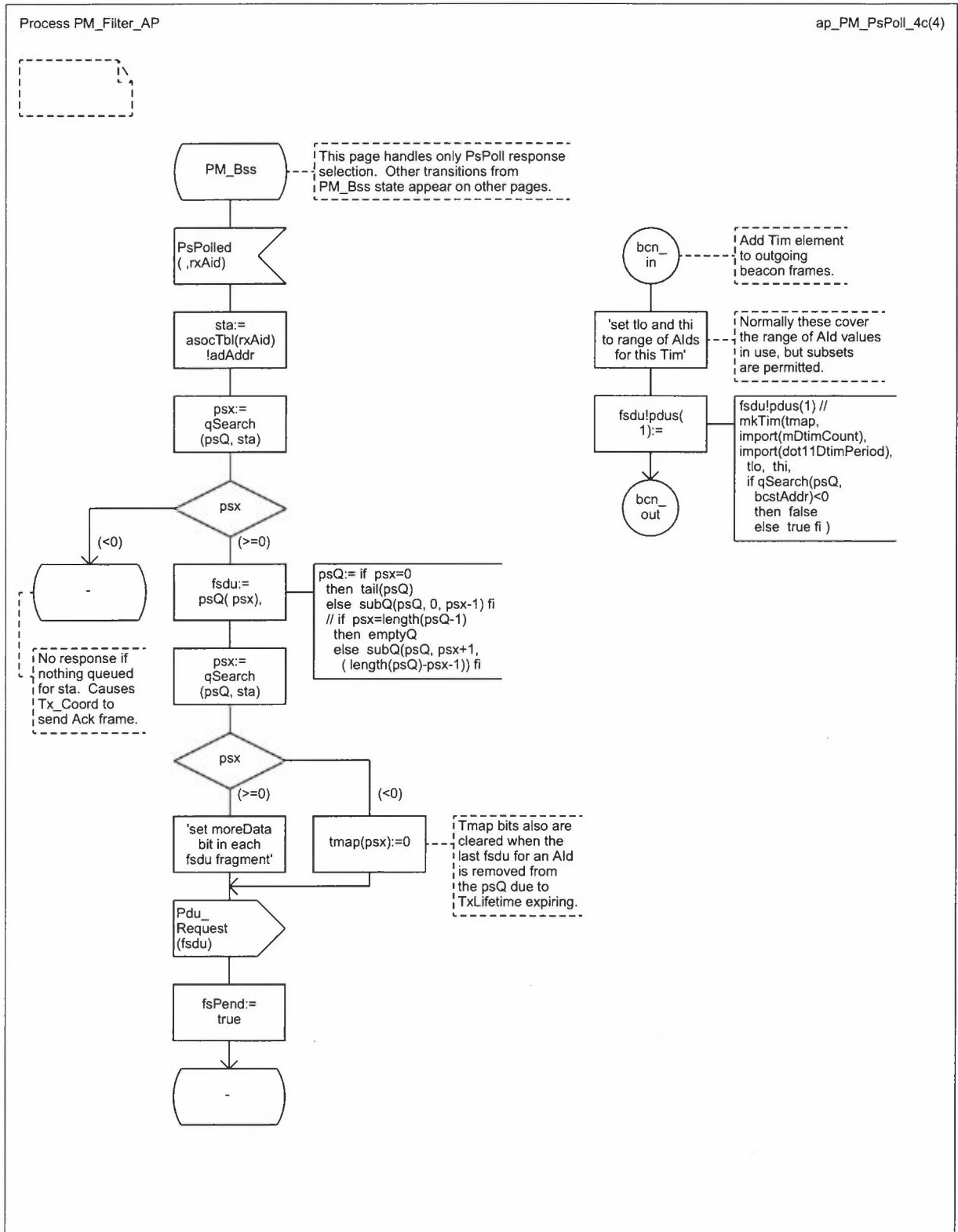


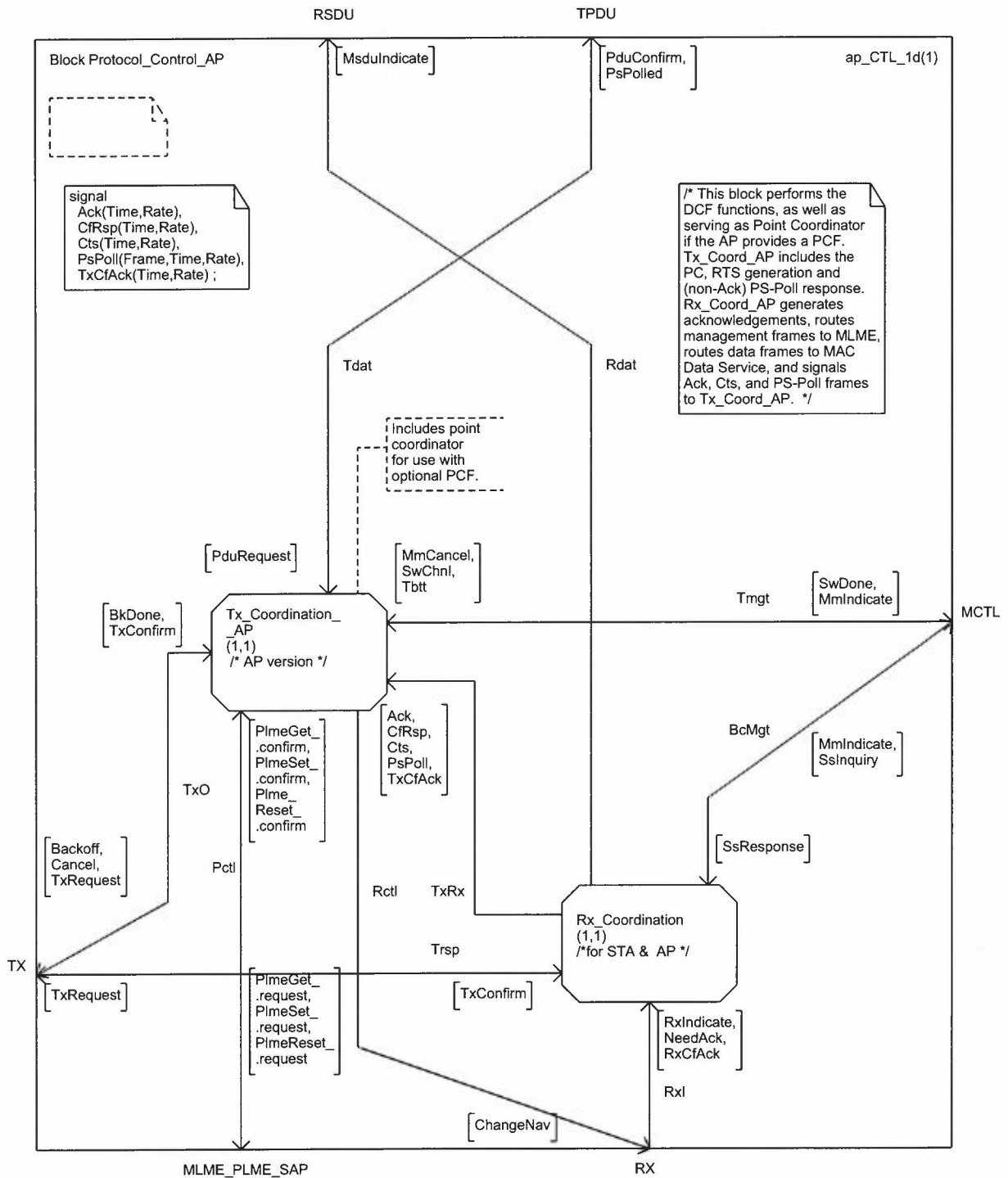
Process PM_Filter_AP

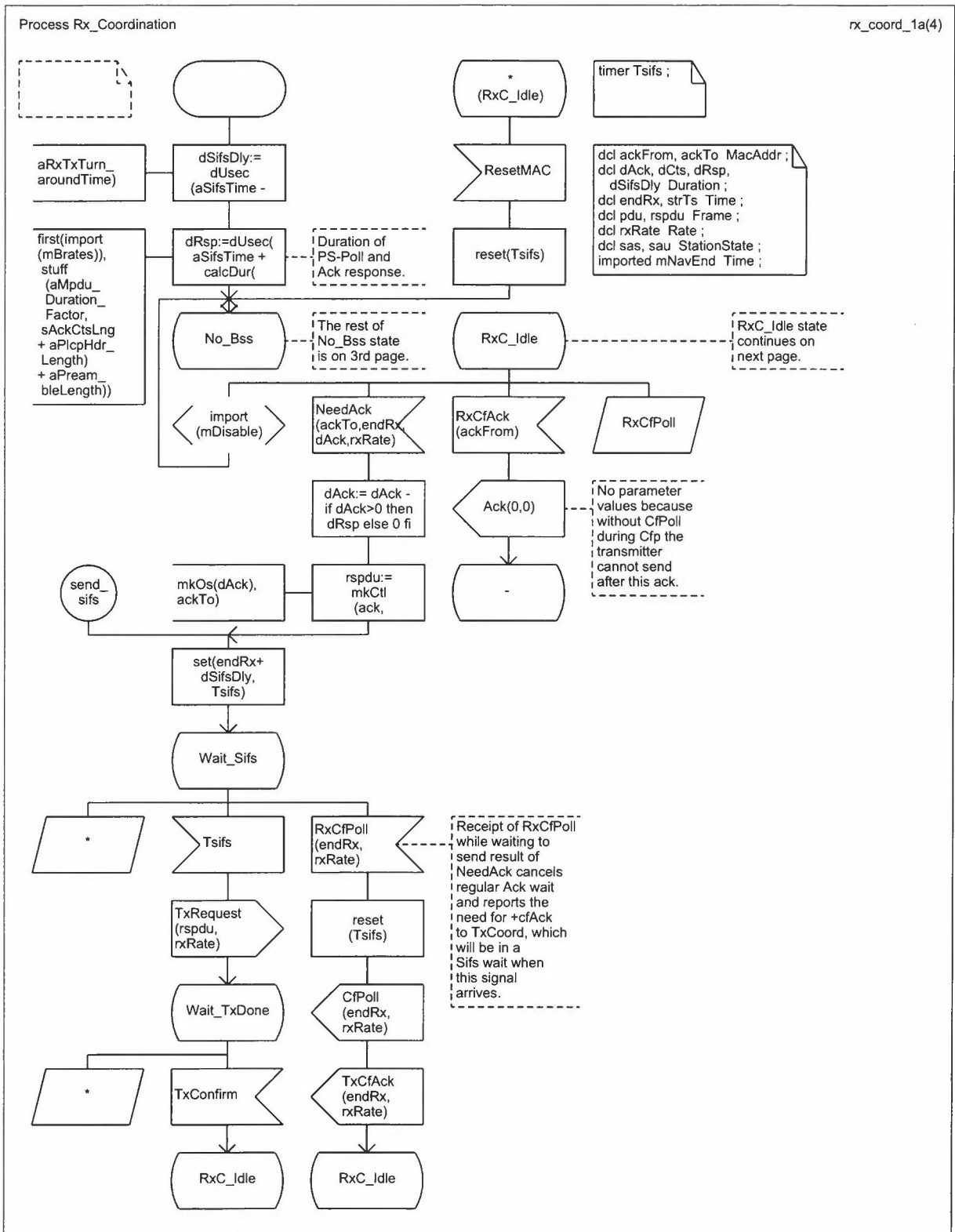
ap_PM_Cfp_2b(4)

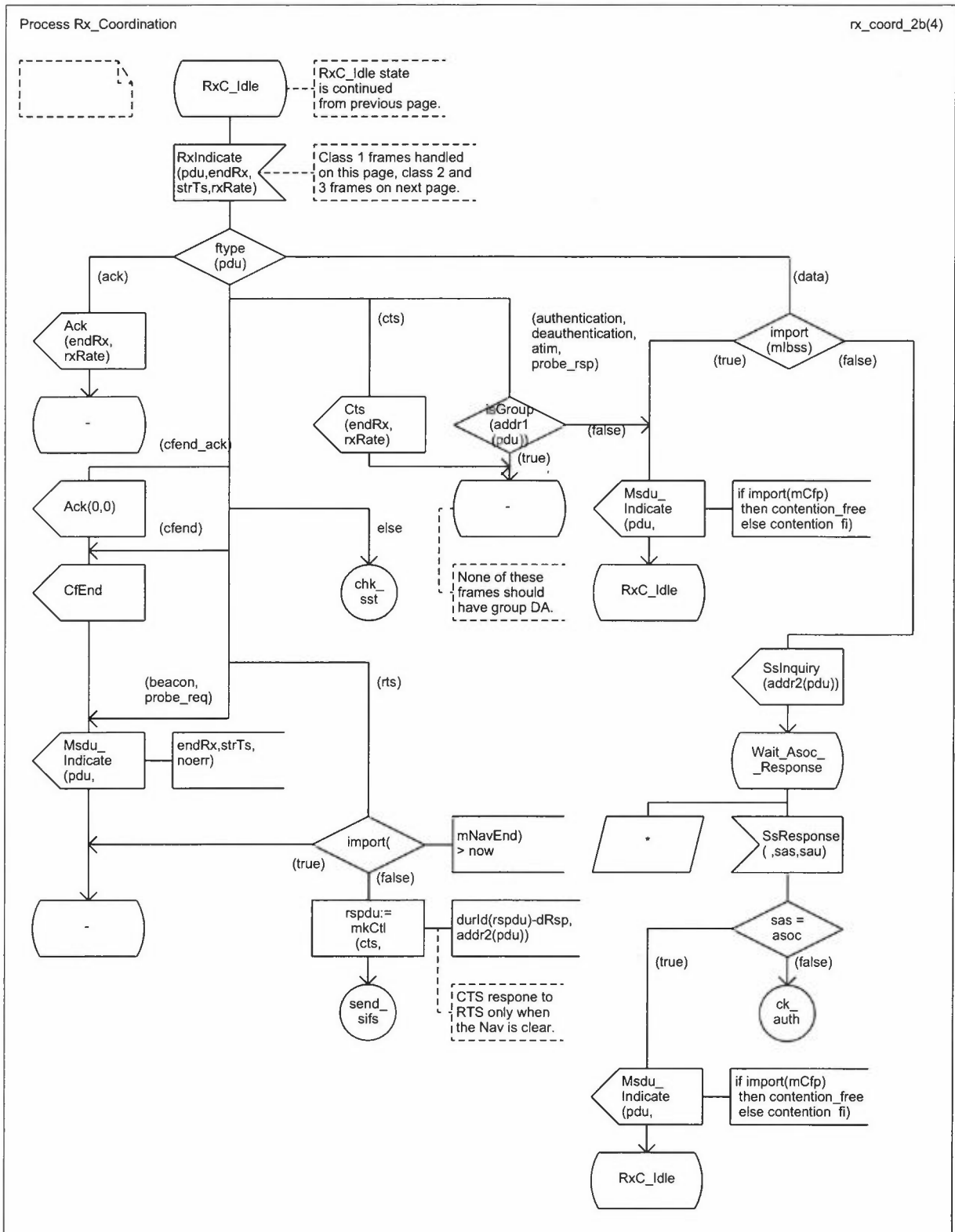


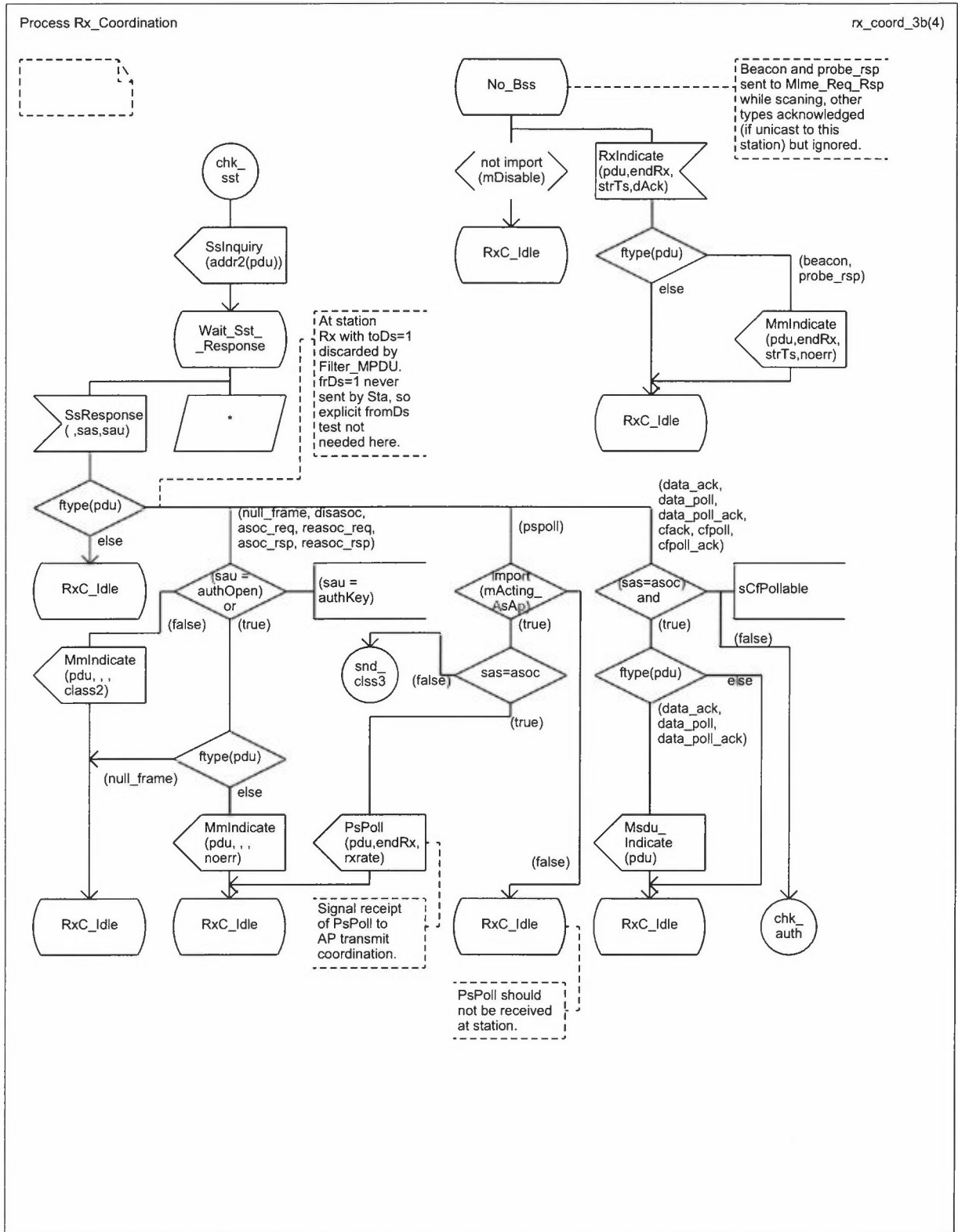


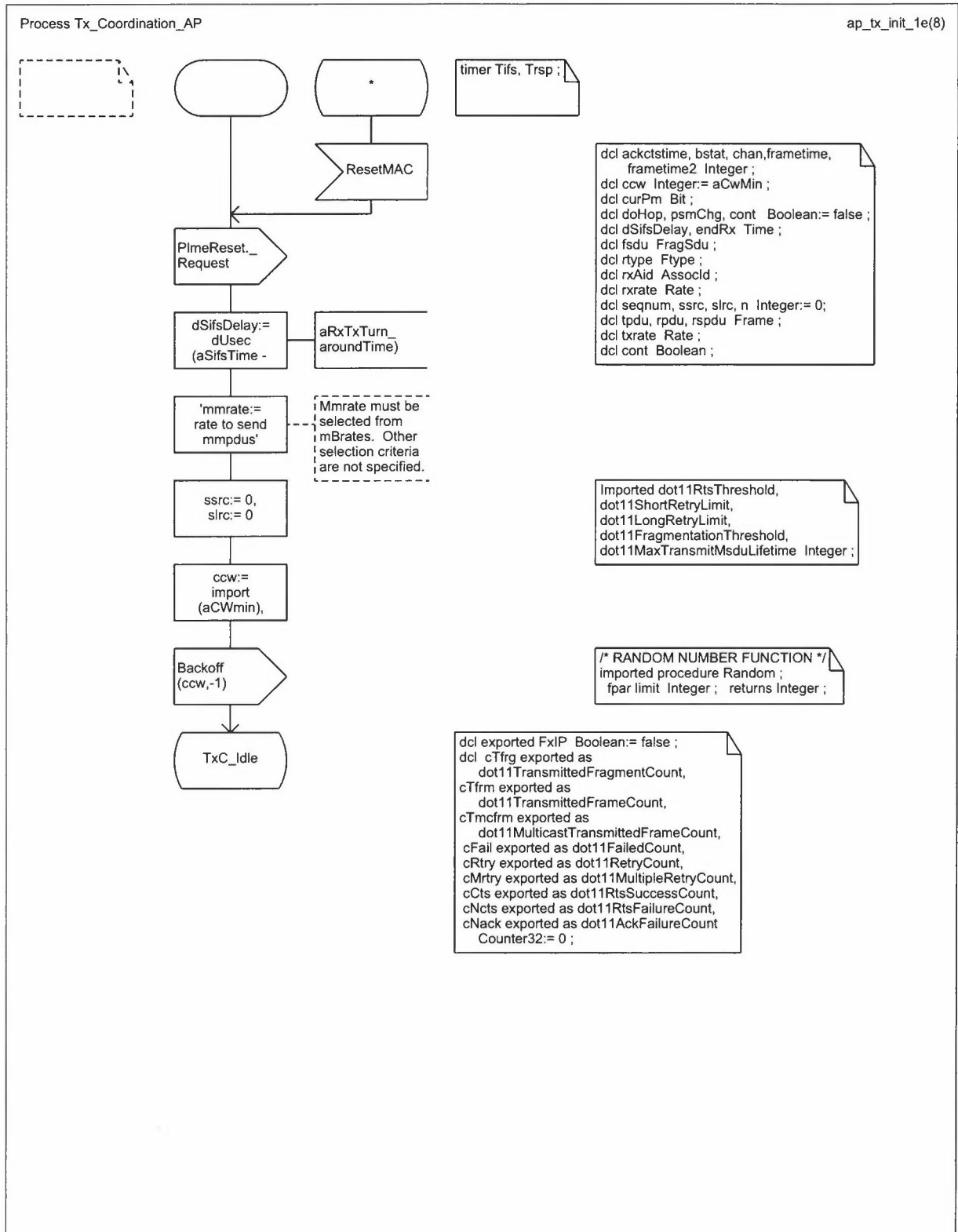


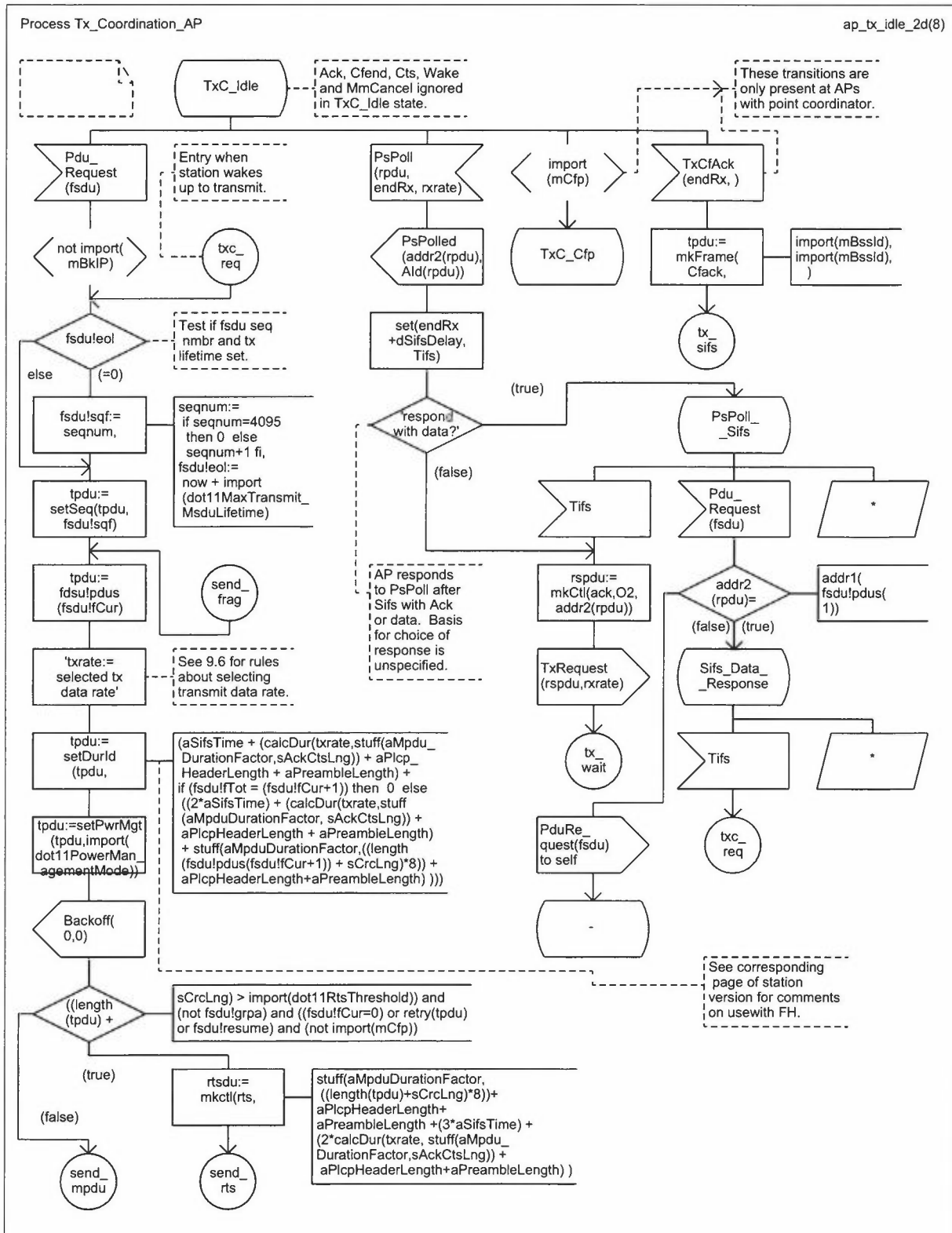


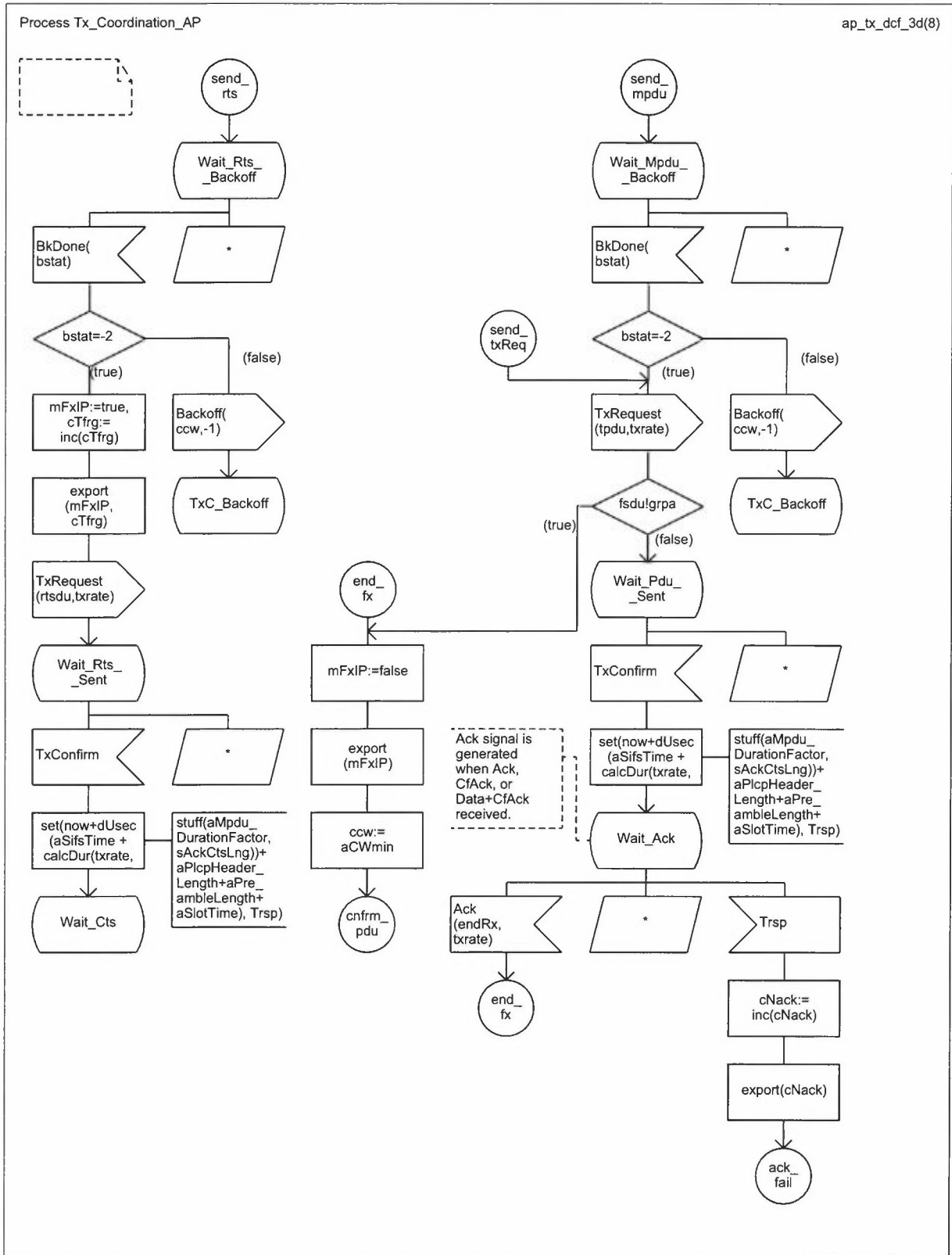


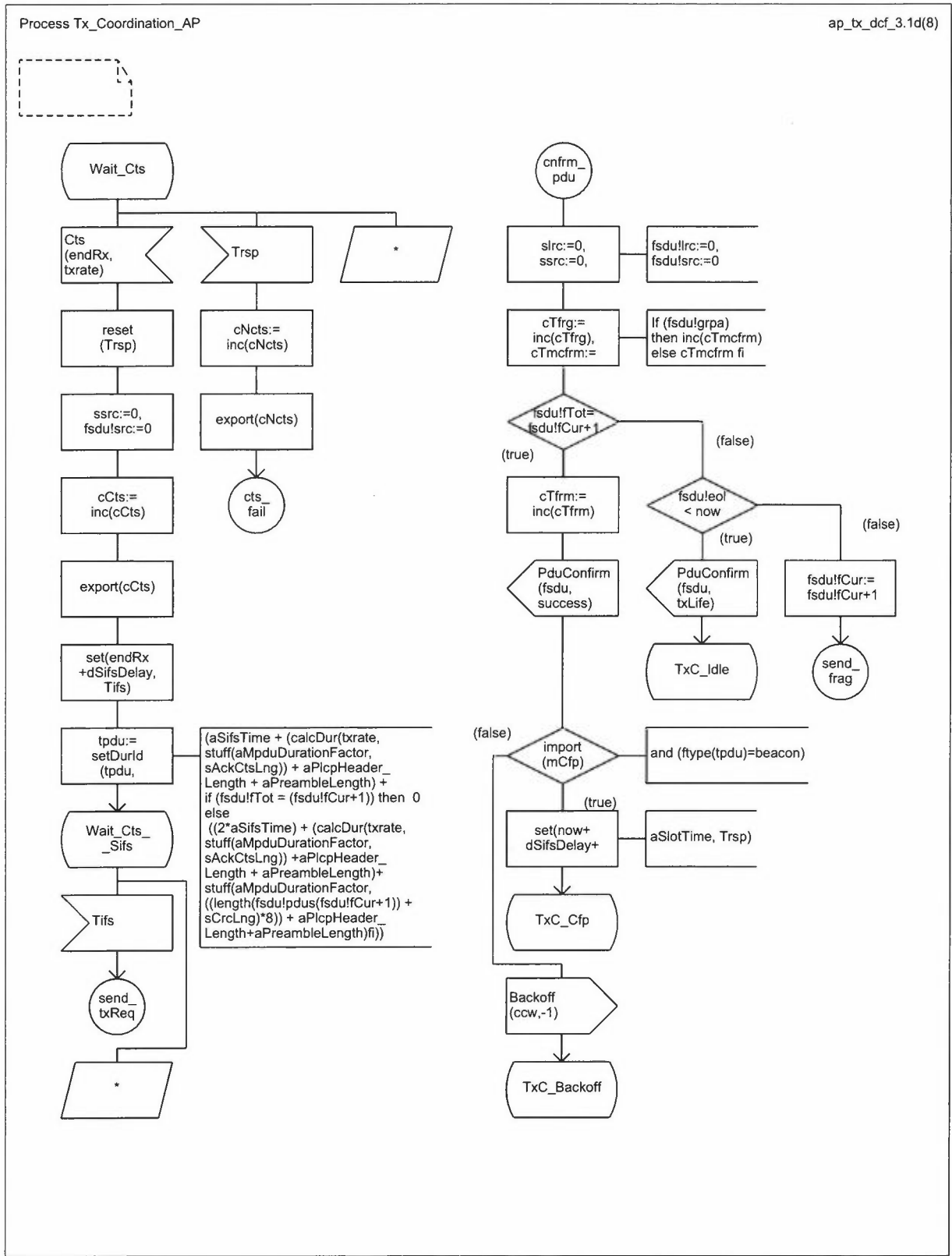


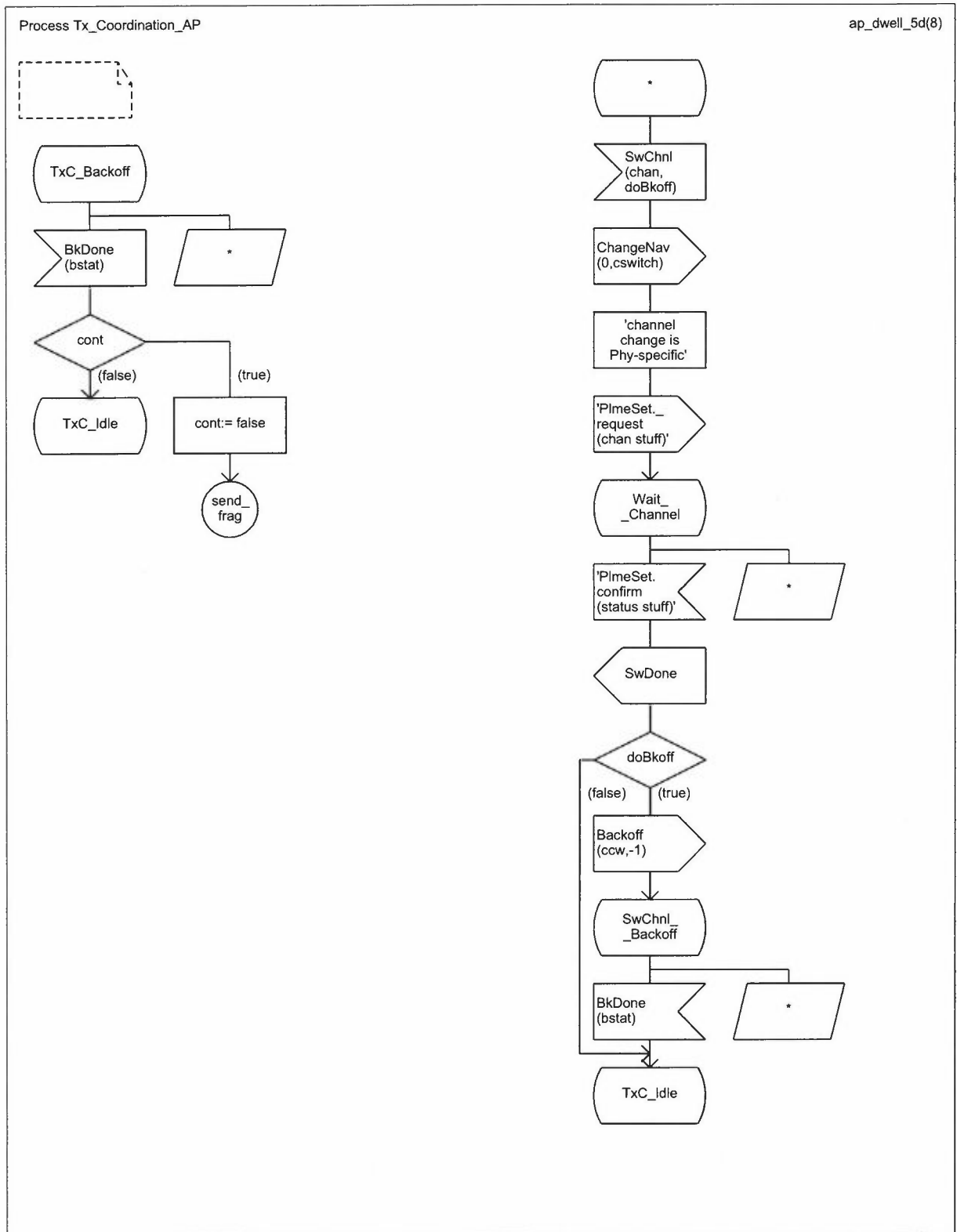


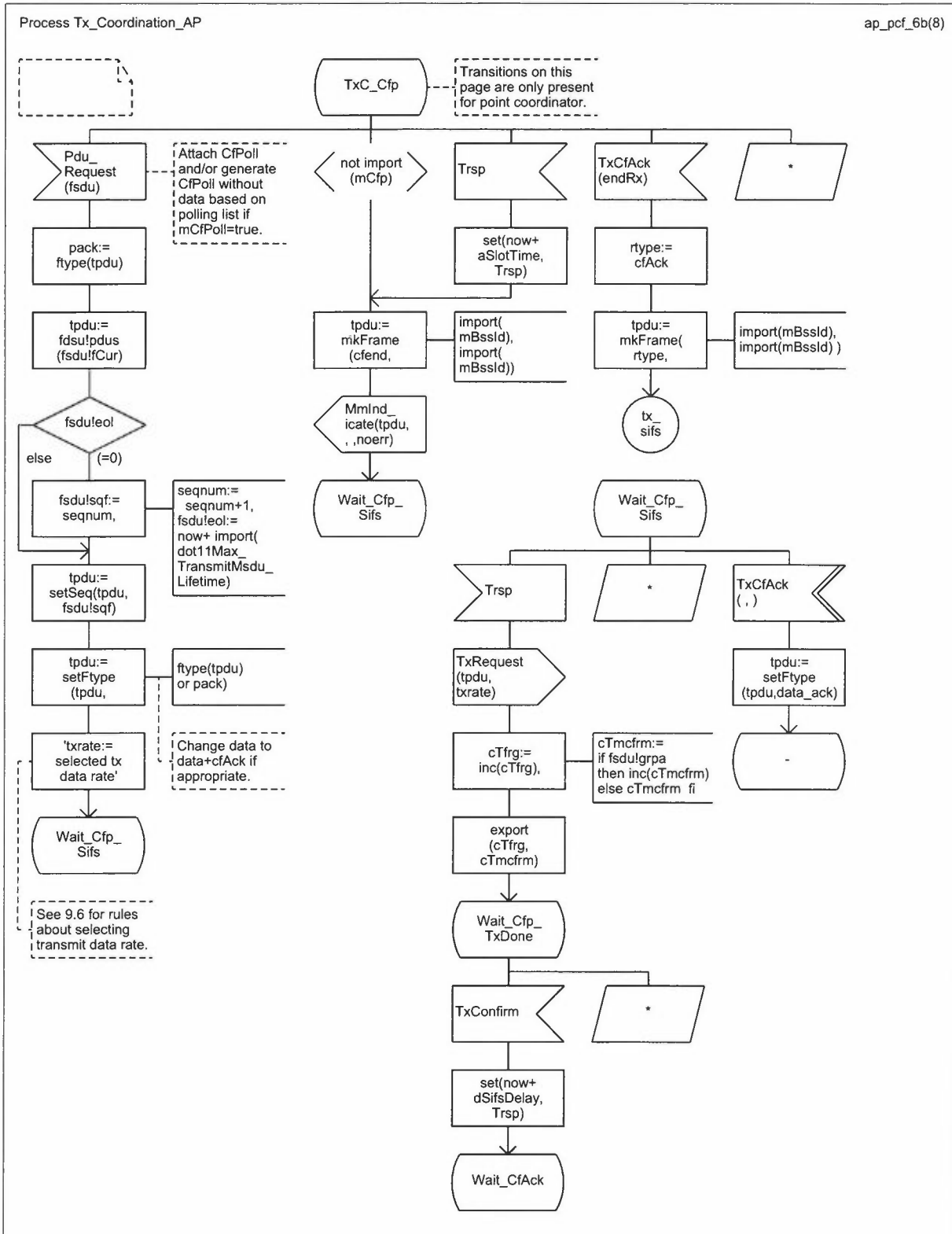


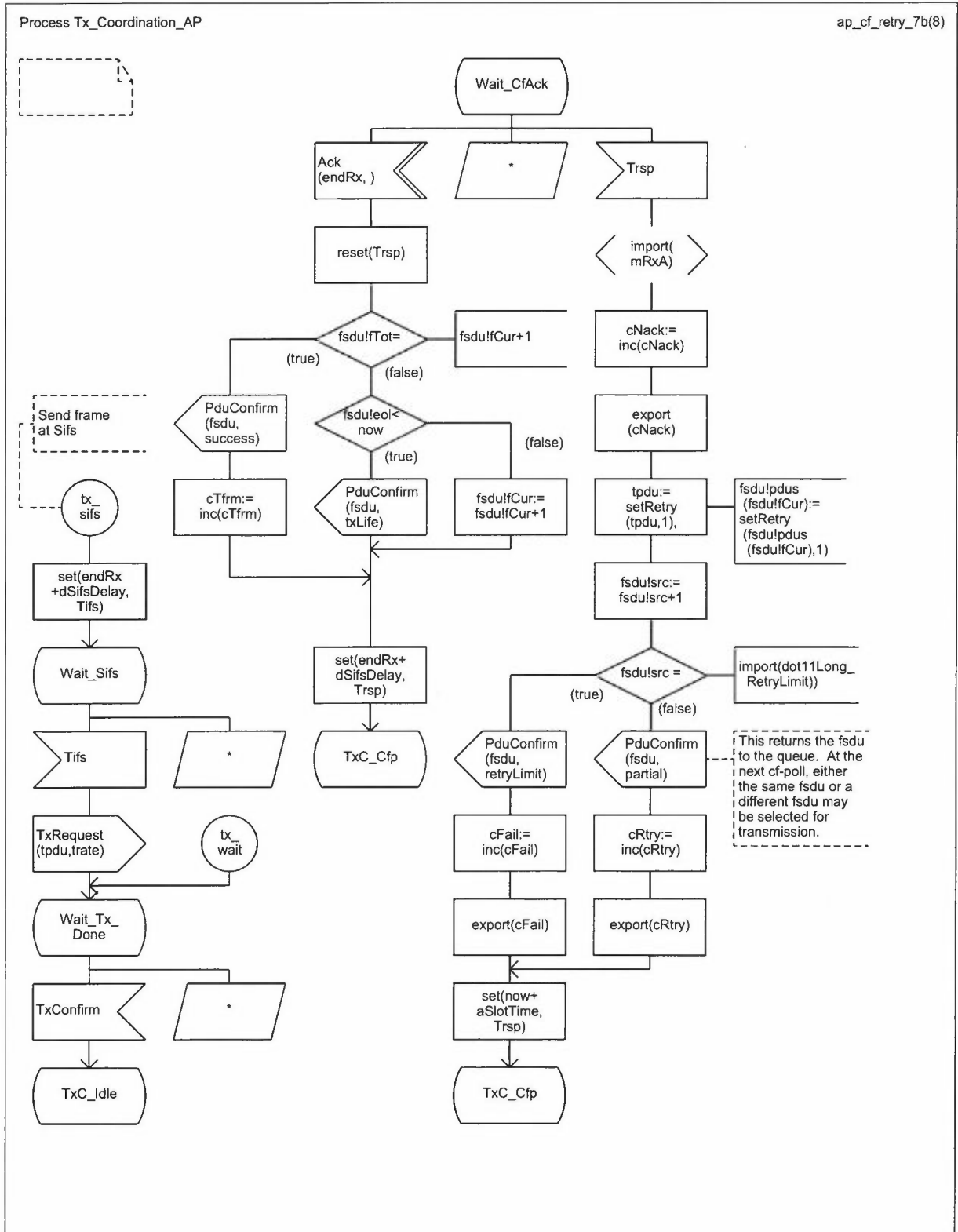


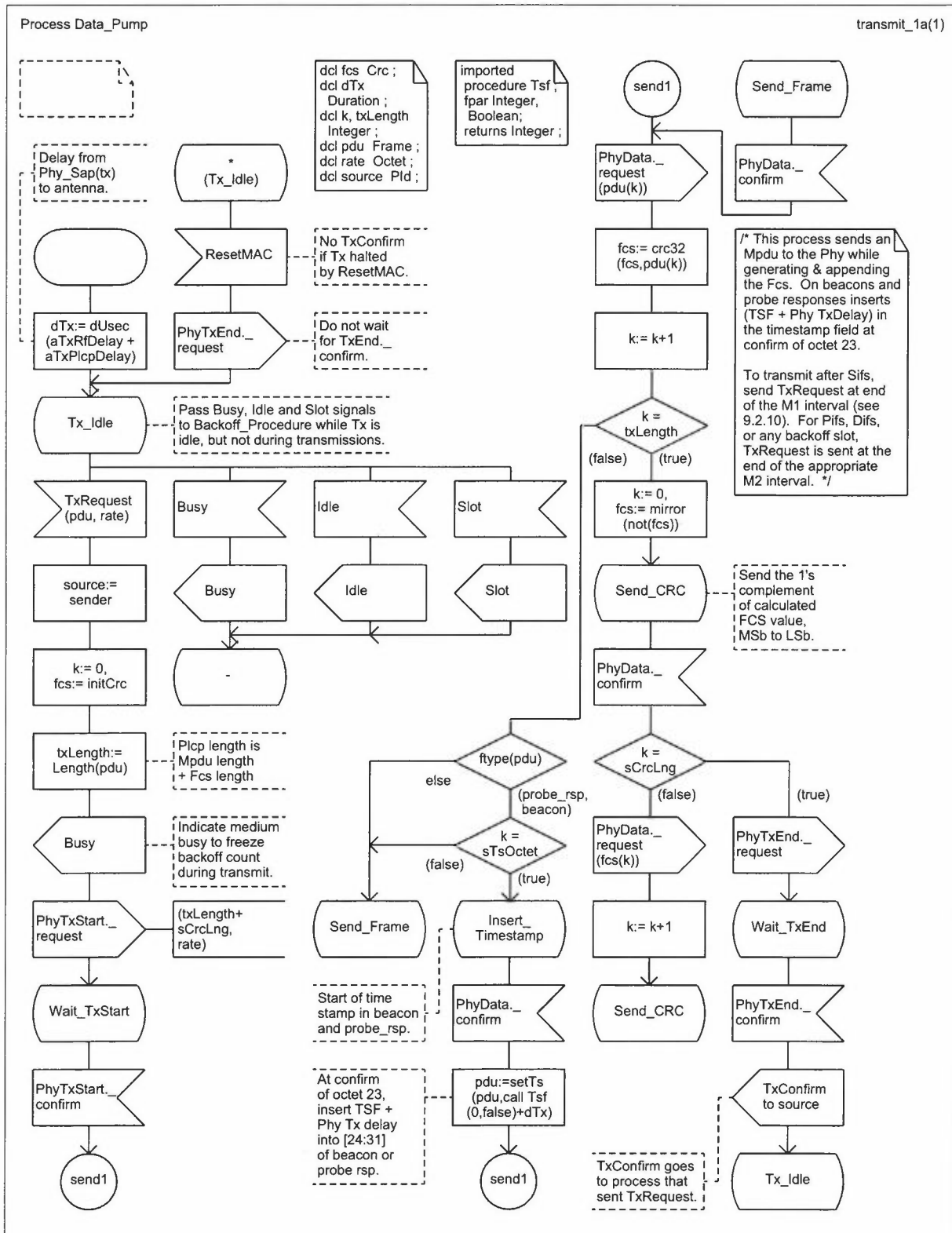


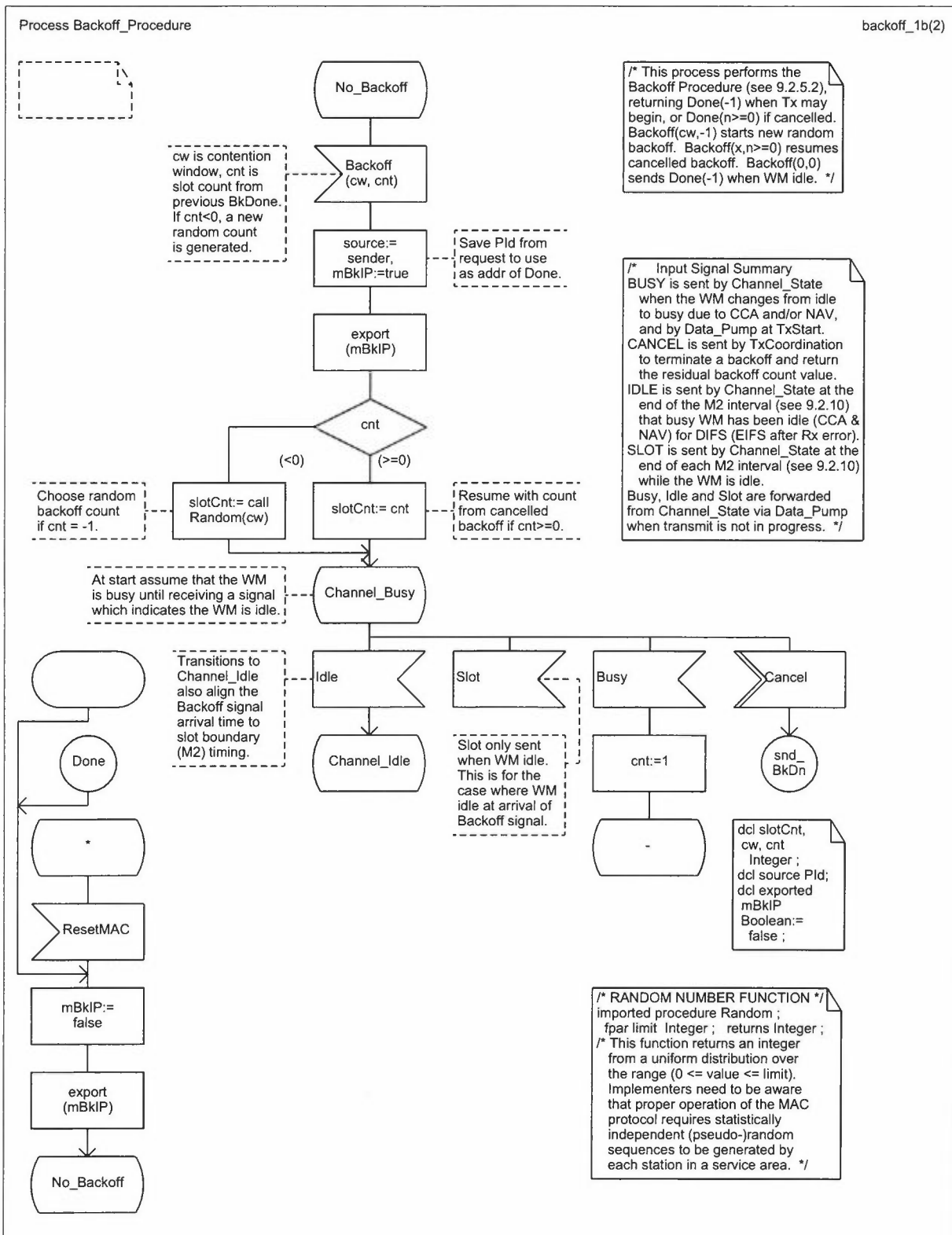


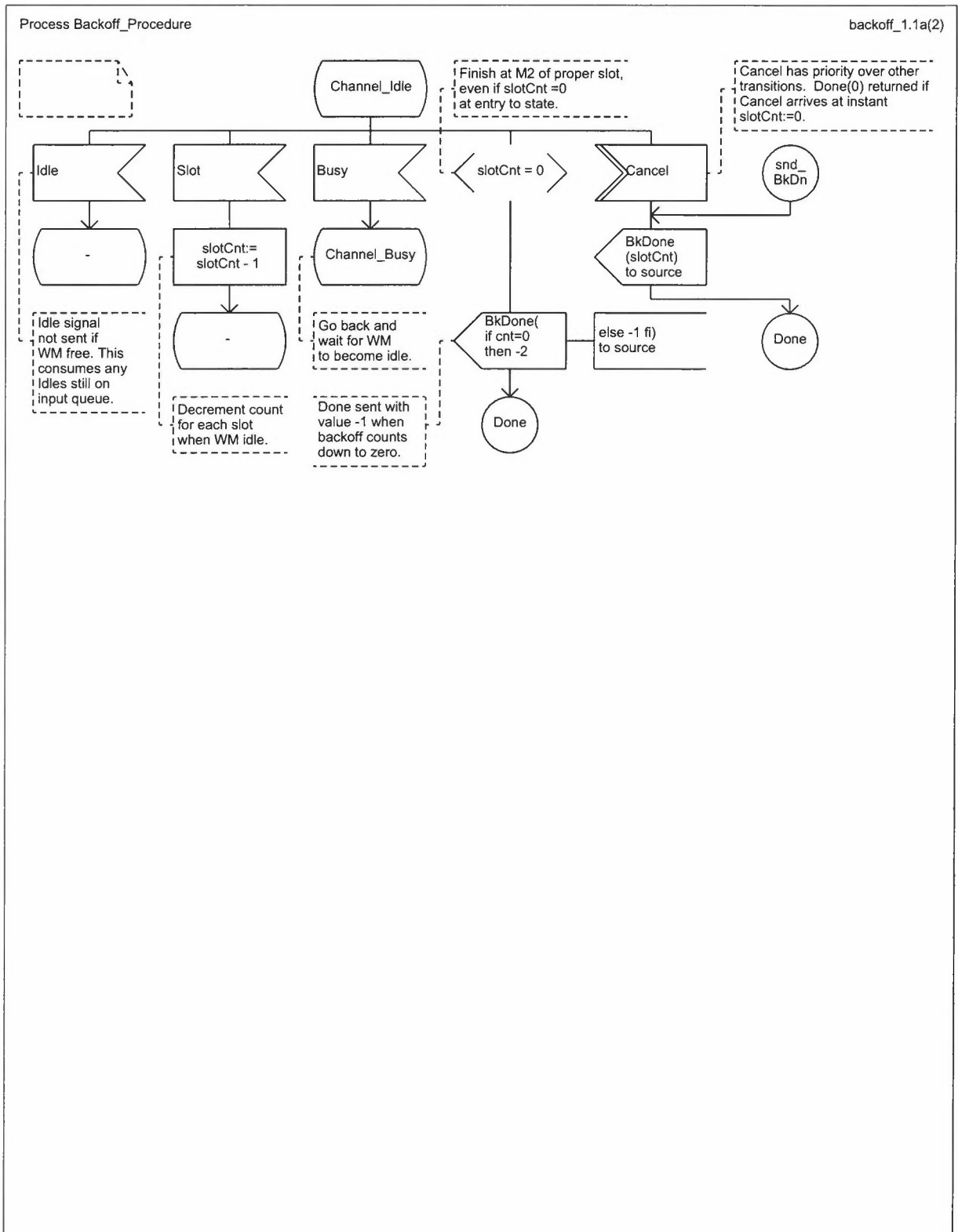


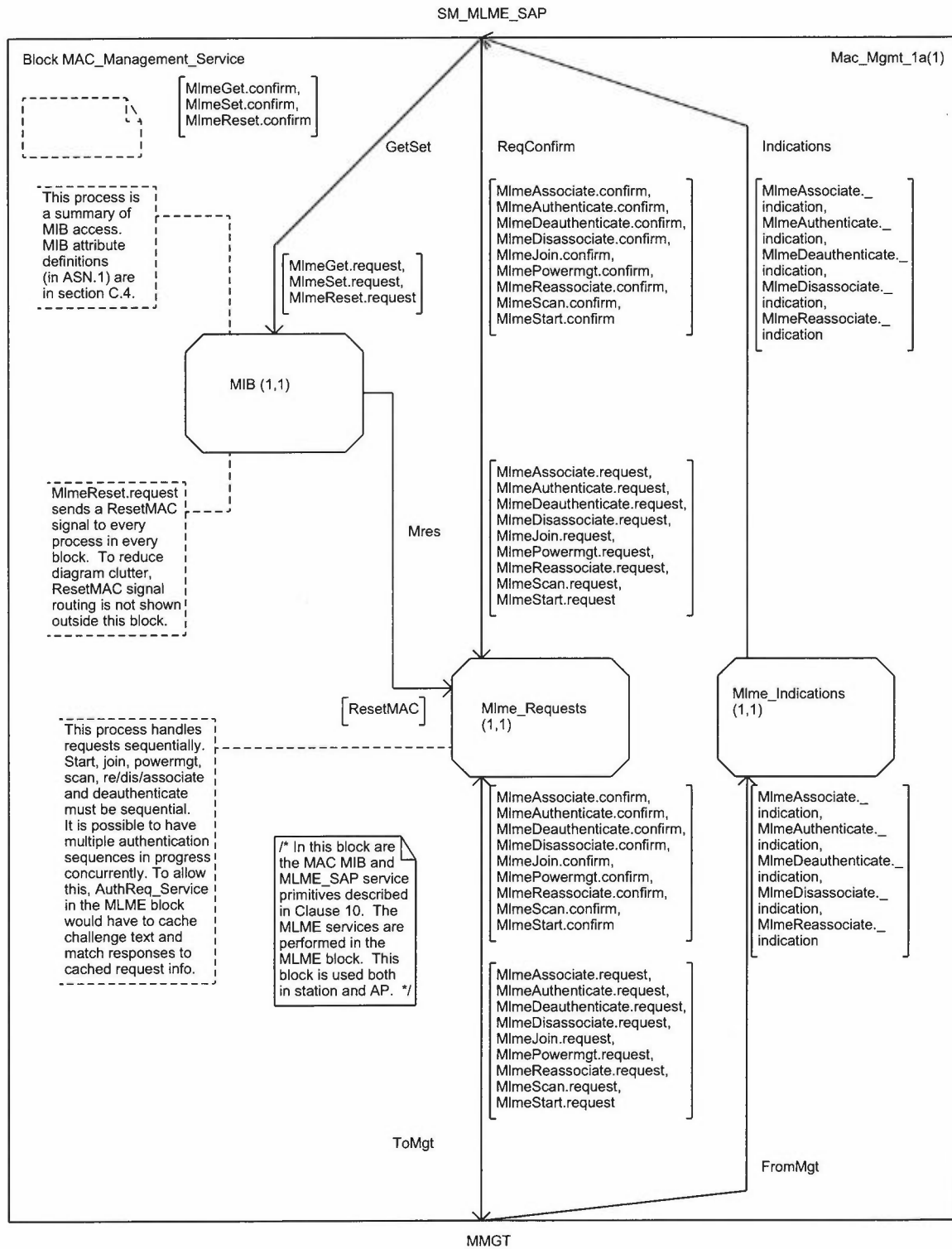


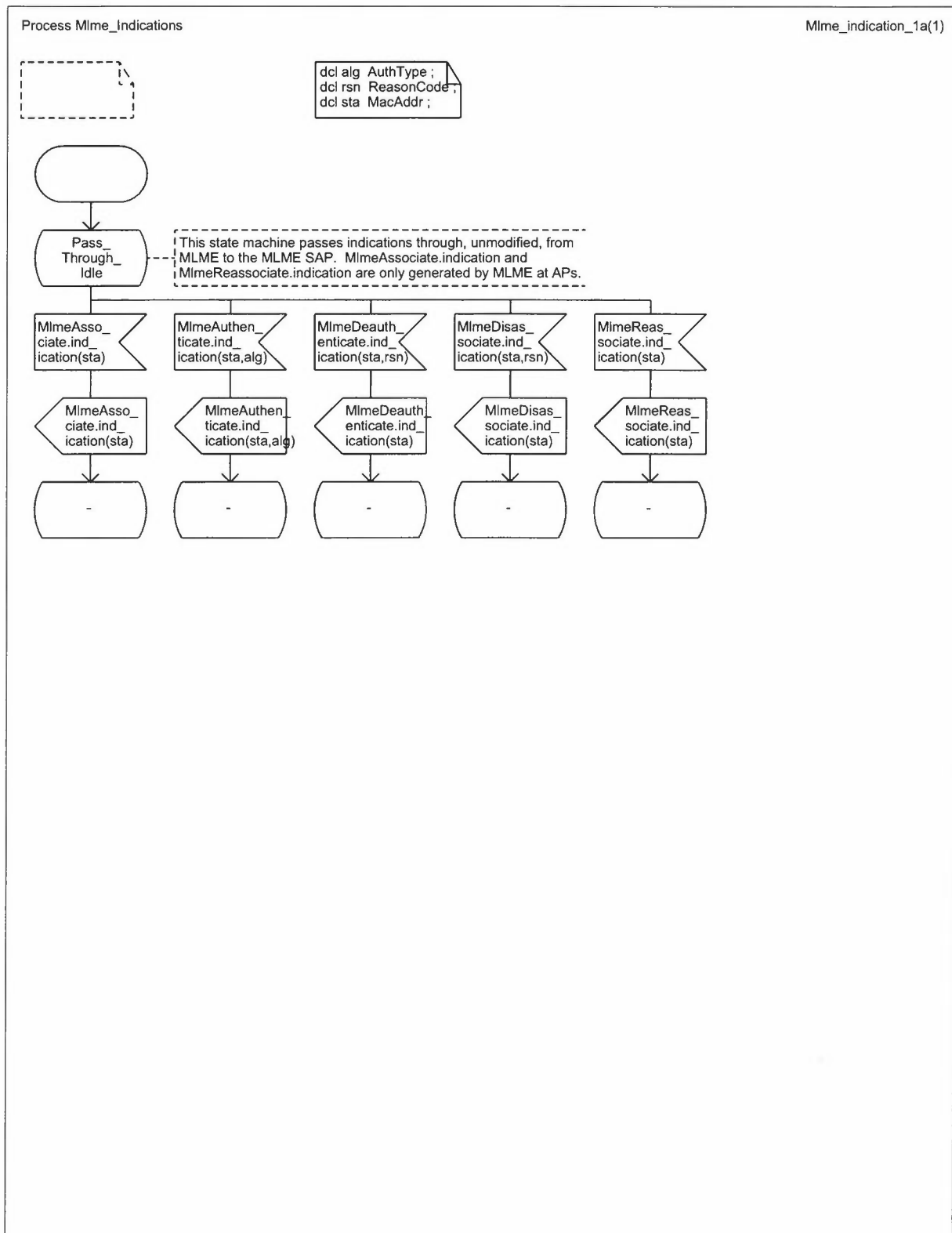


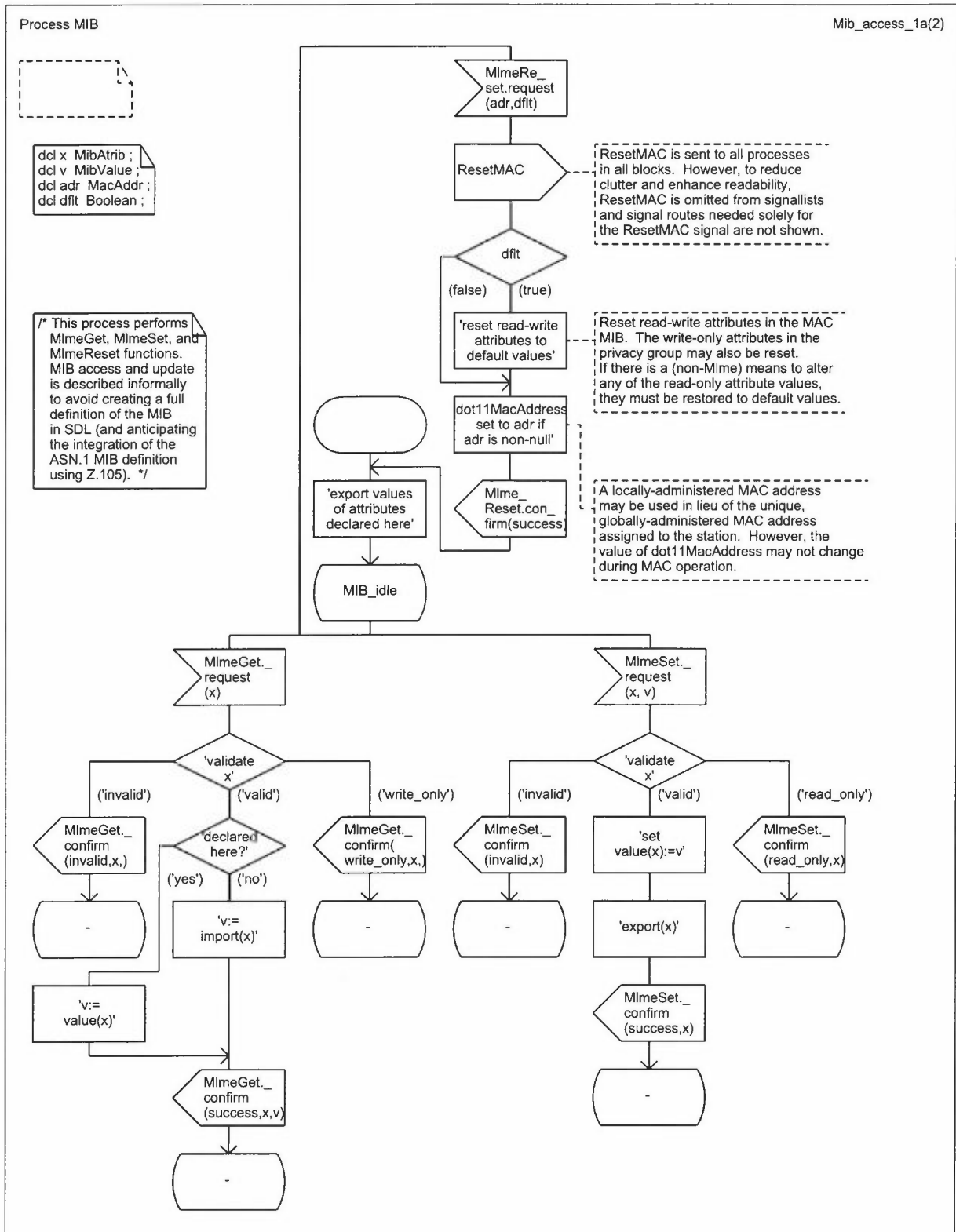












Process MIB

Mib_import_export_2b(2)



```

/* Import of {Read-Only} MIB counter
values exported from other processes */
imported
dot11AckFailureCount,
dot11FailedCount,
dot11FcsErrorCount,
dot11FrameDuplicateCount,
dot11MulticastReceivedFrameCount,
dot11MulticastTransmittedFrameCount,
dot11MultipleRetryCount,
dot11ReceivedFragmentCount,
dot11RetryCount,
dot11RtsFailureCount,
dot11RtsSuccessCount,
dot11TransmittedFragmentCount,
dot11WepExcludedCount,
dot11WepIcvErrorCount,
dot11WepUndecryptableCount Counter32 ;

```

```

/* Declarations of MIB attributes exported from
this process */

/* Read-Write attributes */
dcl exported
dot11AuthenticationAlgorithms AuthTypeSet:=
incl(open_system, shared_key),
dot11ExcludeUnencrypted Boolean:= false,
dot11FragmentationThreshold Integer:= 2346,
dot11GroupAddresses MacAddrSet:= empty,
dot11LongRetryLimit Integer:= 4,
dot11MaxReceiveLifetime Kusec:= 512,
dot11MaxTransmitMsduLifetime Kusec:= 512,
dot11MediumOccupancyLimit Kusec:= 100,
dot11PrivacyInvoked Boolean:= false,
mReceiveDTIMs Boolean:= true,
dot11CfpPeriod Integer:= 1,
dot11CfpMaxDuration Kusec:= 200,
dot11AuthenticationResponseTimeout Kusec:= 512,
dot11RtsThreshold Integer:= 3000,
dot11ShortRetryLimit Integer:= 7,
dot11WepDefaultKeyId KeyIndex:= 0,
dot11CurrentChannelNumber Integer:= 0,
dot11CurrentSet Integer:= 0,
dot11CurrentPattern Integer:= 0,
dot11CurrentIndex Integer:= 0 ;

/* Write-Only attributes */
dcl exported
dot11WepDefaultKeys KeyVector:= nullKey,
dot11WepKeyMappings
KeyMapArray:= ( . nullAddr, false, nullKey . ) ;

```

```

/* The following Read-Only attributes in the
MAC MIB are defined as synonyms (named
constants) rather than remote variables
because they describe properties of the
station which are static, at least during
any single instance of MAC operation:
dot11AuthenticationAlgorithms AuthTypeSet,
dot11CfpPollable Boolean,
dot11MacAddress MacAddr,
dot11ManufacturerID Octetstring,
dot11PrivacyOptionImplemented Boolean,
dot11ProductID Octetstring,
aStationID MacAddr,
dot11WepKeyMappingLength Integer ;

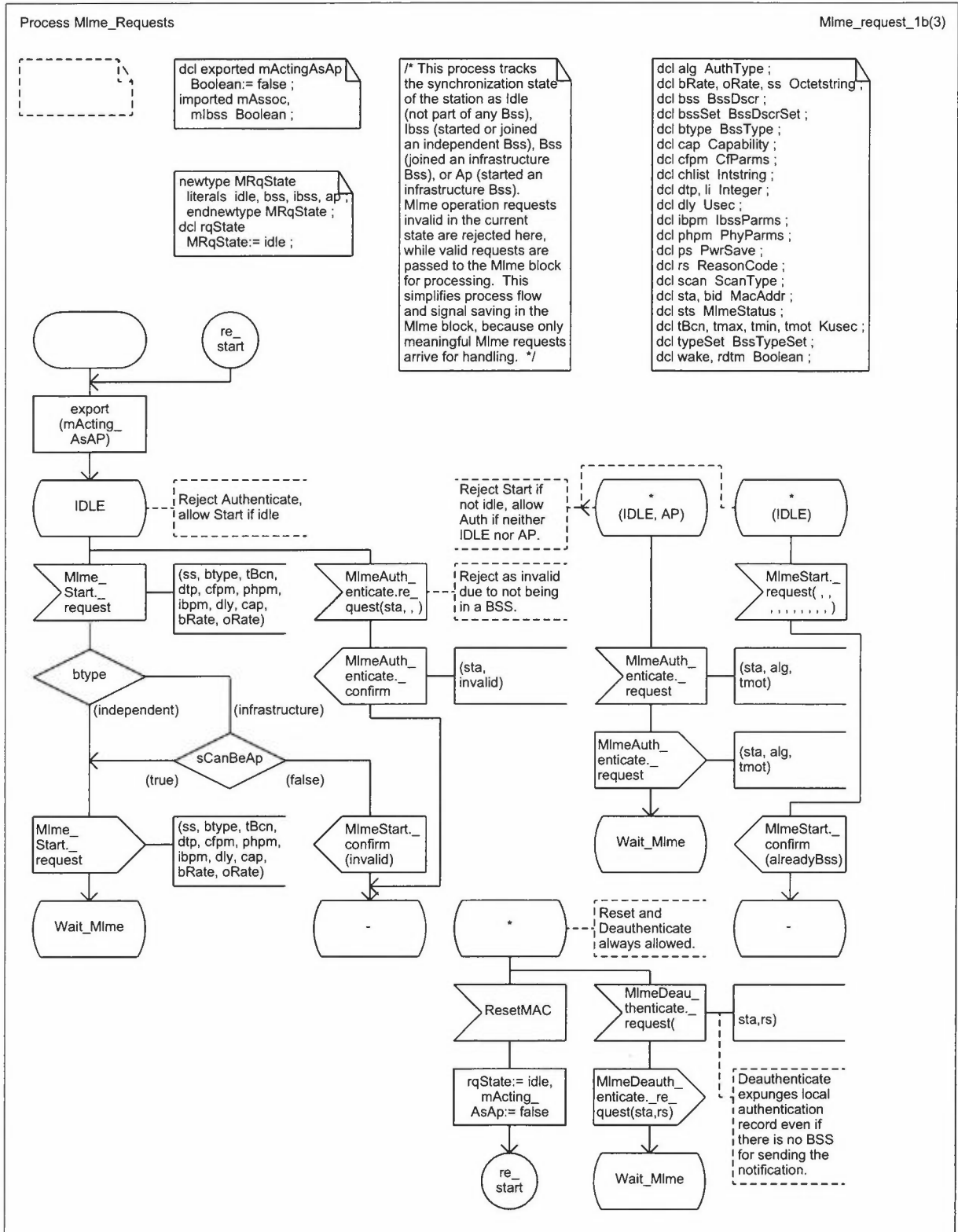
In addition, all Read-Only attributes in the
PHY MIB which are accessed by the MAC
are defined as synonyms.
*/

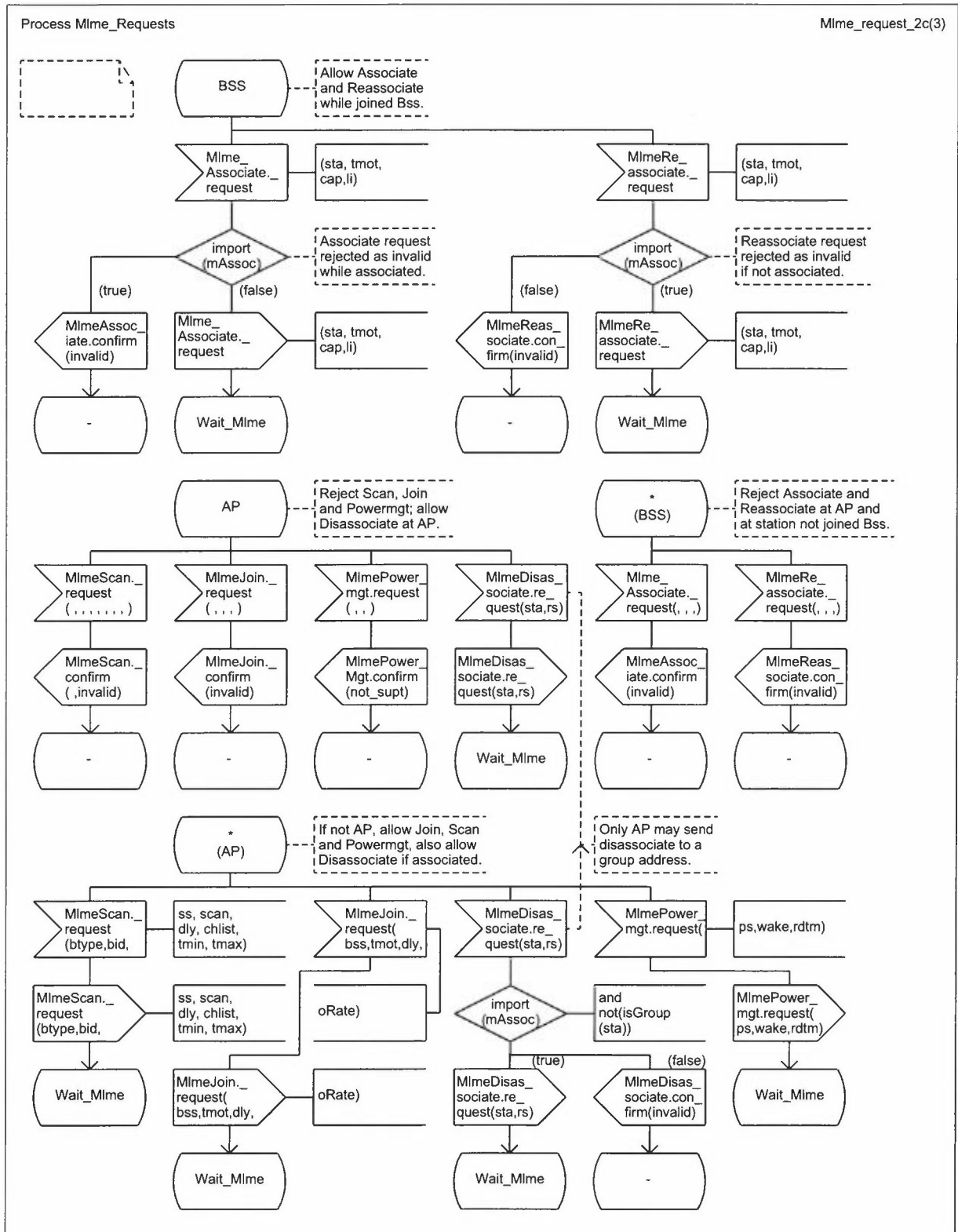
```

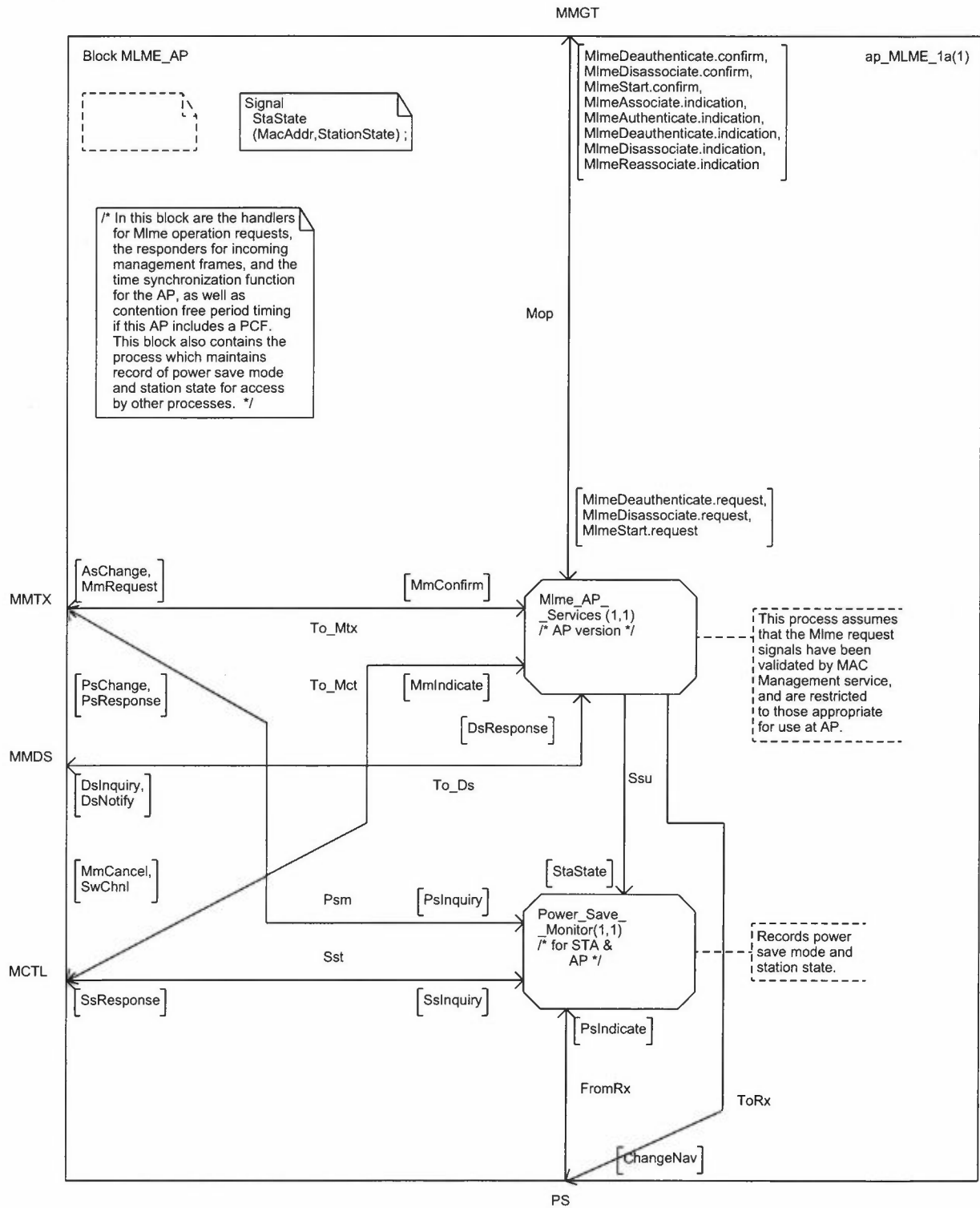
```

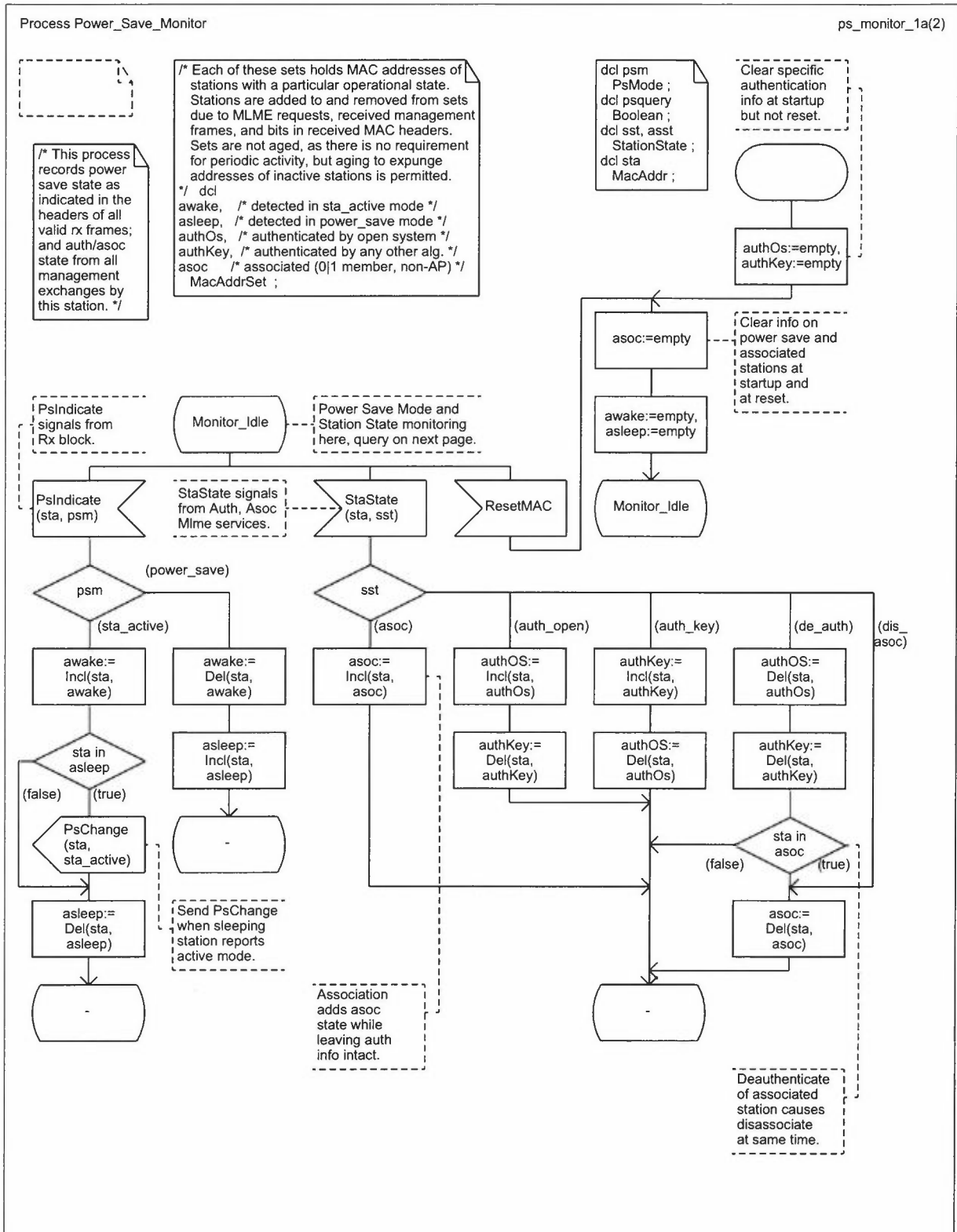
/* NOTE:
The values listed for MAC MIB attributes are the
specified default values for those attributes.
The values listed for PHY MIB attributes are either
the default values for the FH PHY, or arbitrary
values within the specified range. The specific
values for PHY attributes in this SDL description
of the MAC do not have normative significance.
*/

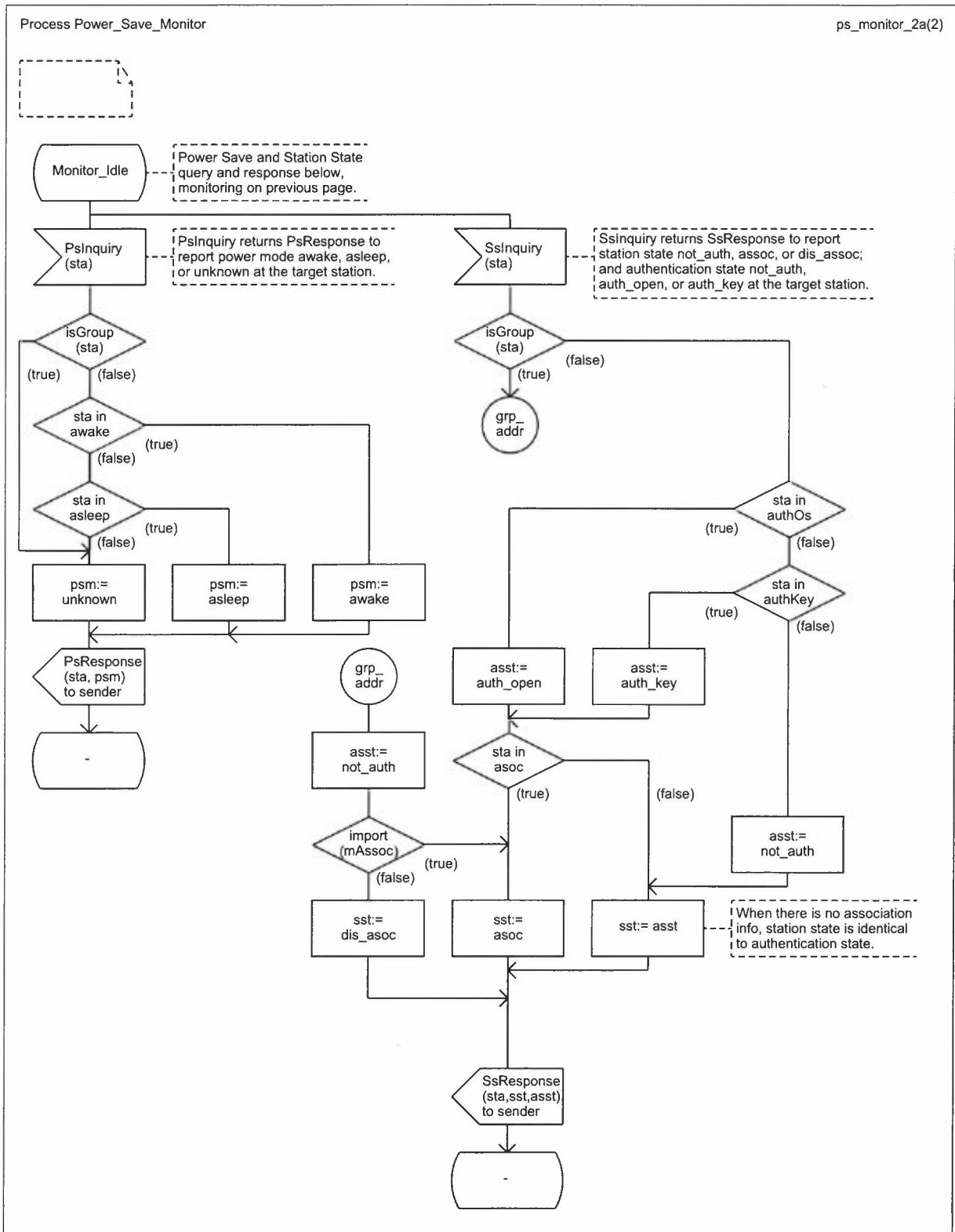
```

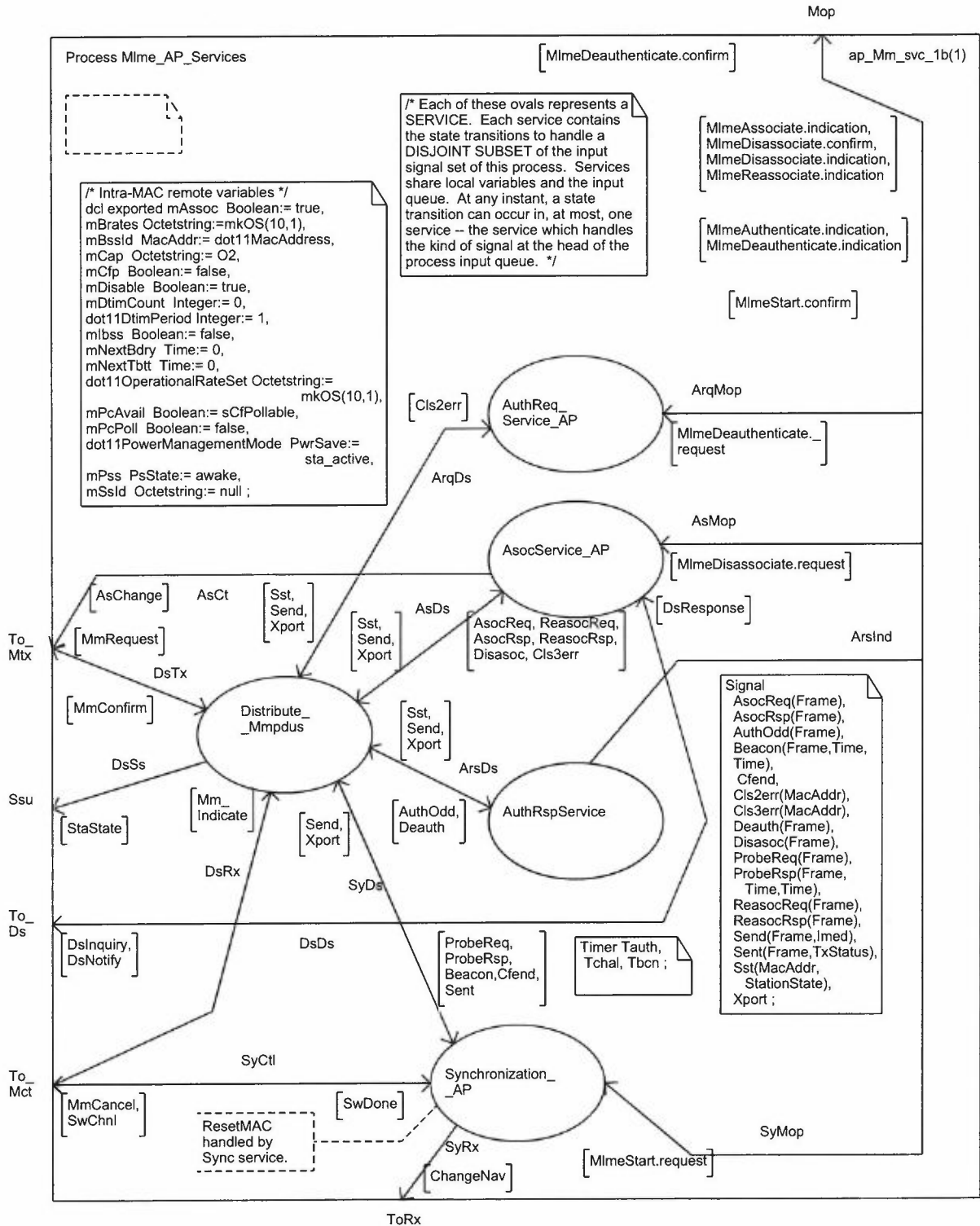












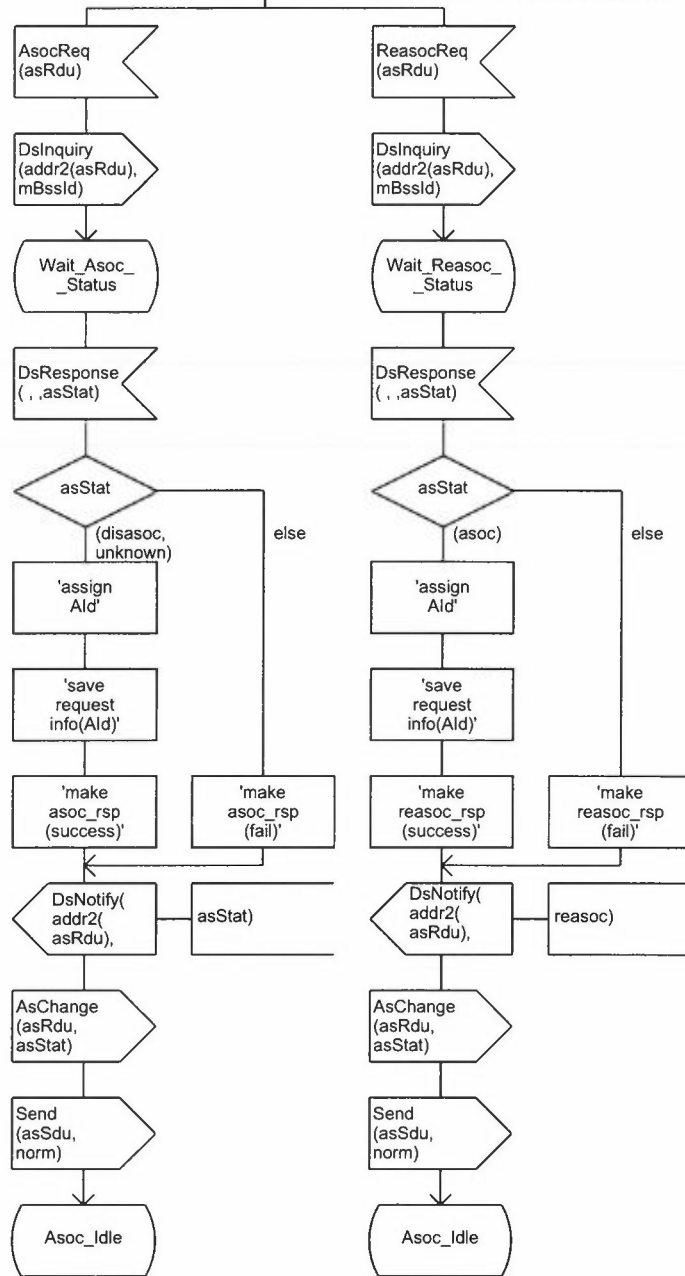
Service AsocService_AP

ap_asoc_reasoc_2a(2)



Asoc_Idle

On this page are response to associate and reassociate requests. More of this state on previous page.



Service AuthReqService_AP

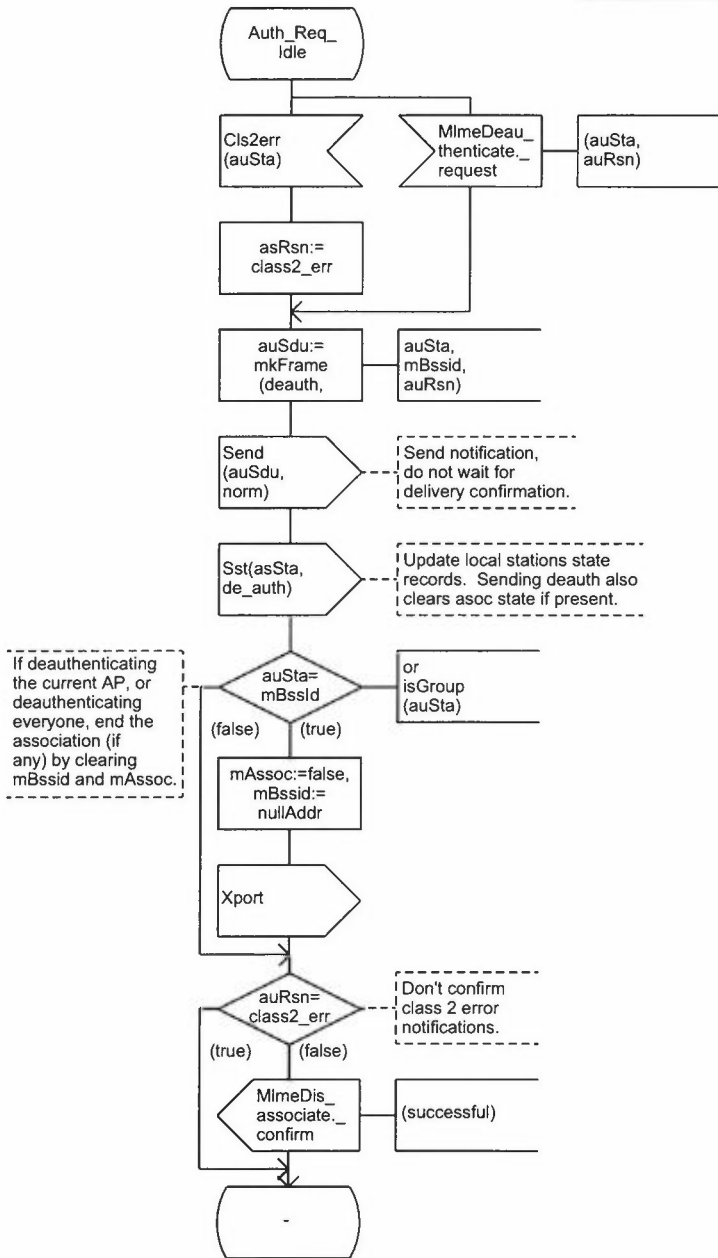
ap_auth_req_1a(1)

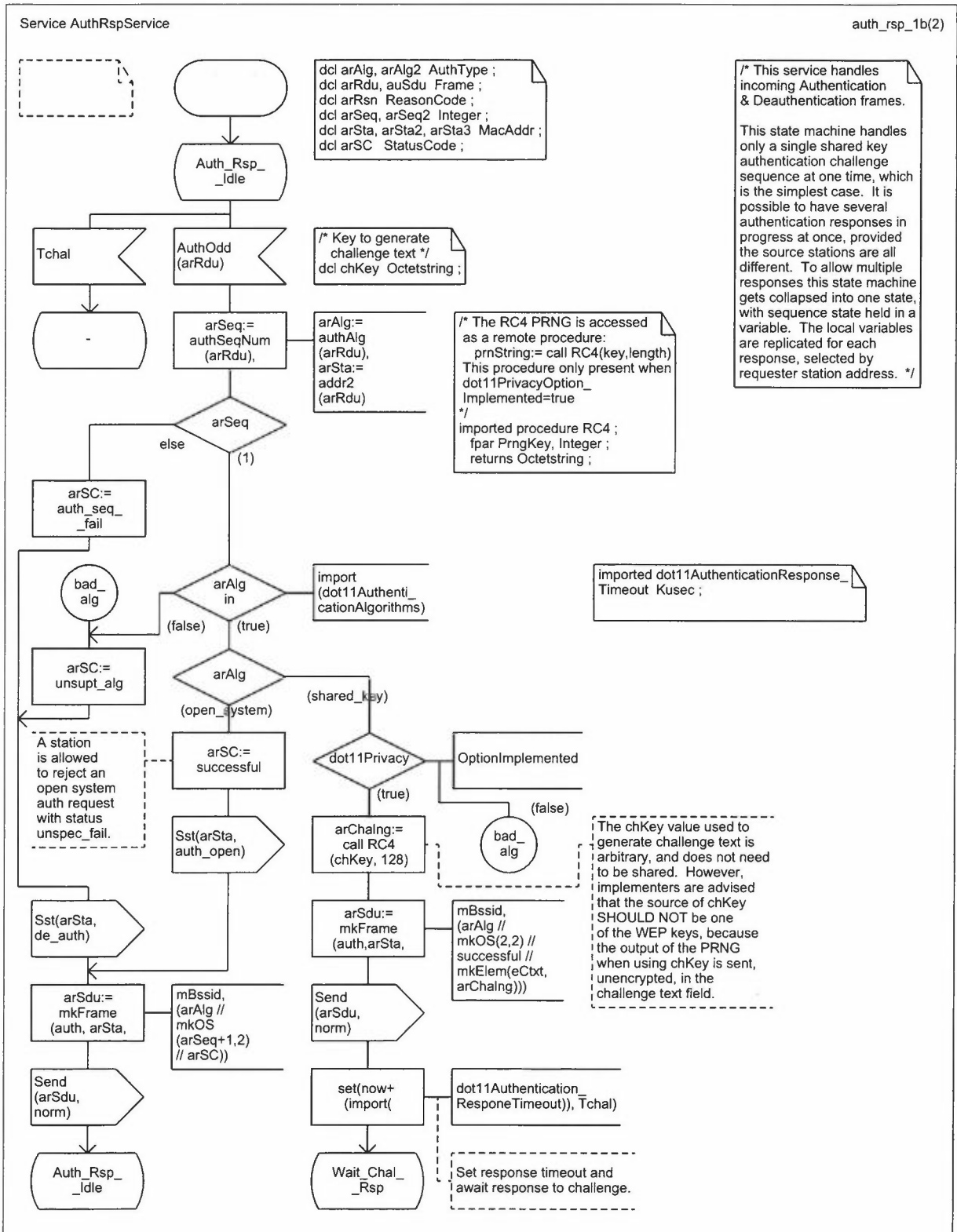


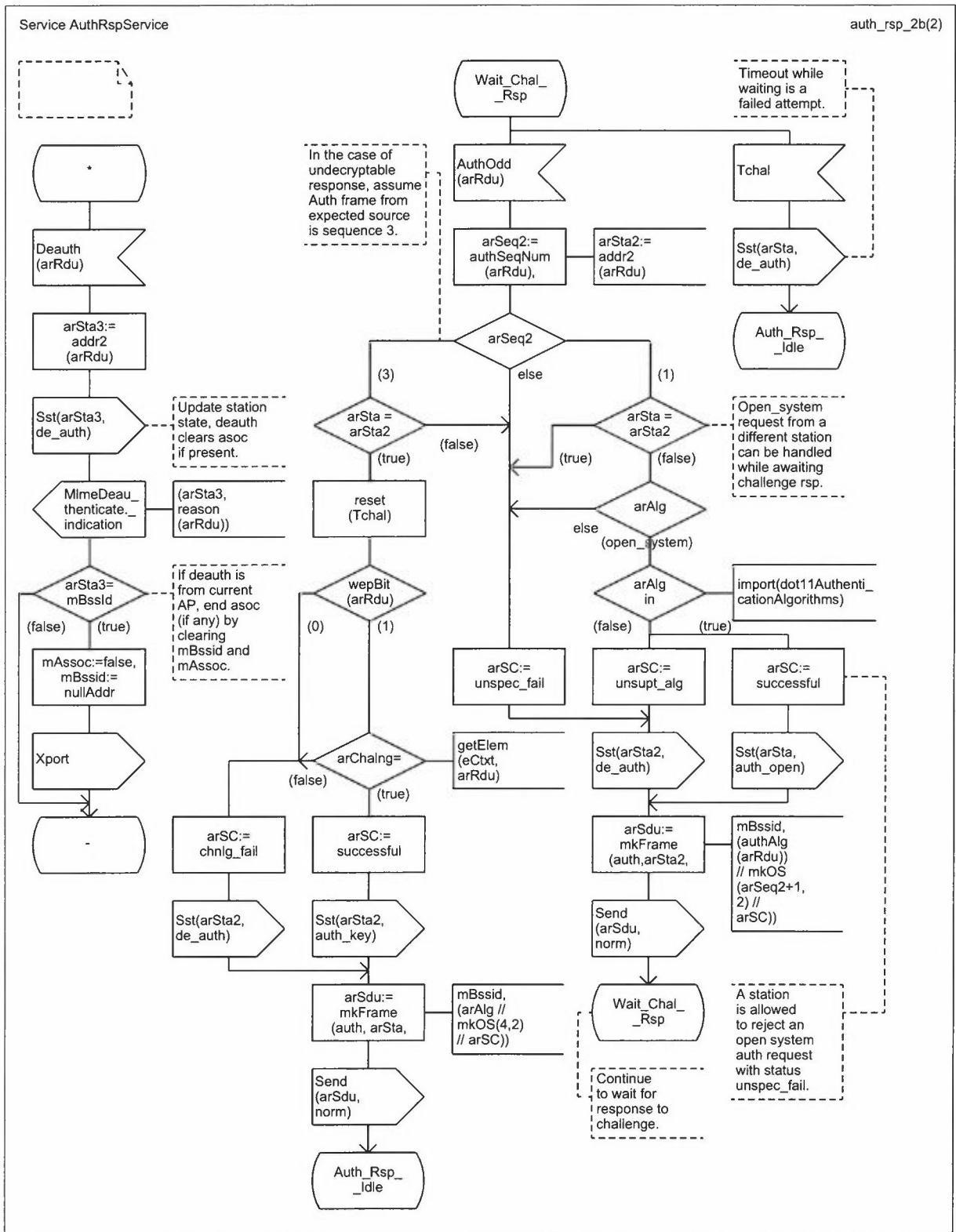
```
dcl auAlg AuthType ;
dcl auCap Capability ;
dcl auRdu, auSdu Frame ;
dcl auRsn ReasonCode ;
dcl auSta MacAddr ;
dcl auSts TxResult ;
dcl auTmot Kusec ;
```

```
/* This service handles
DeAuthenticate requests.
This service also handles
incoming the generation of
responses for class 2 errors.

This service does not
do authenticate requests
because APs never
initiate authentication. */
```

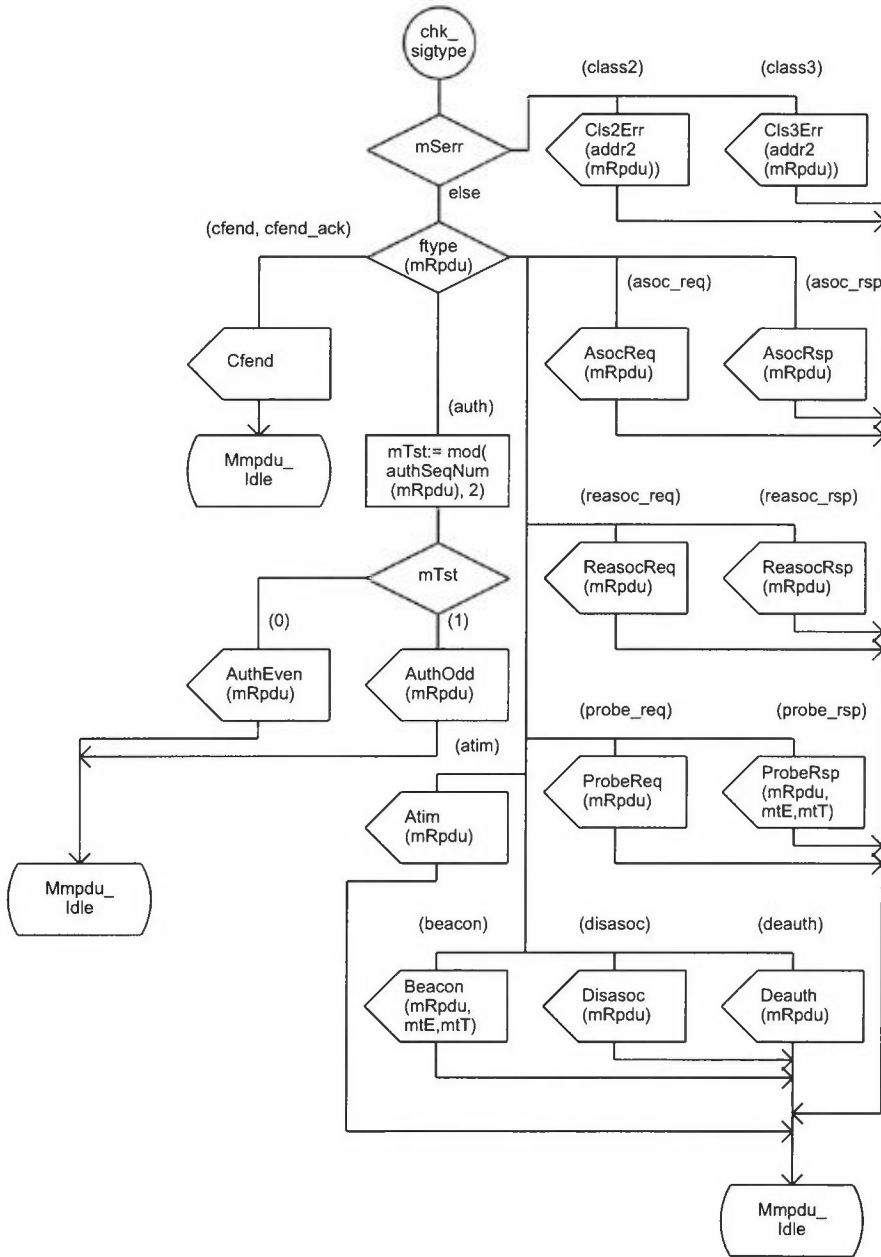


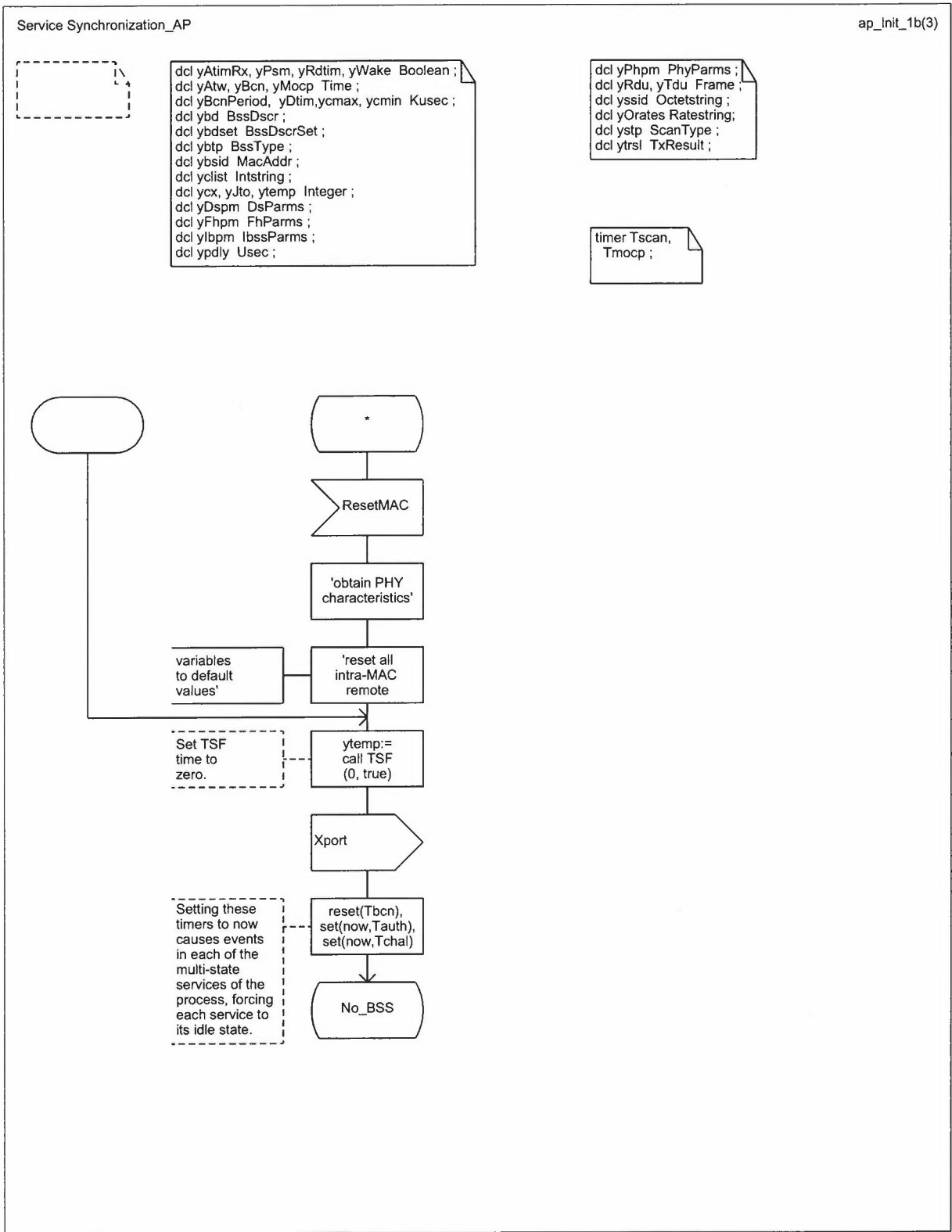


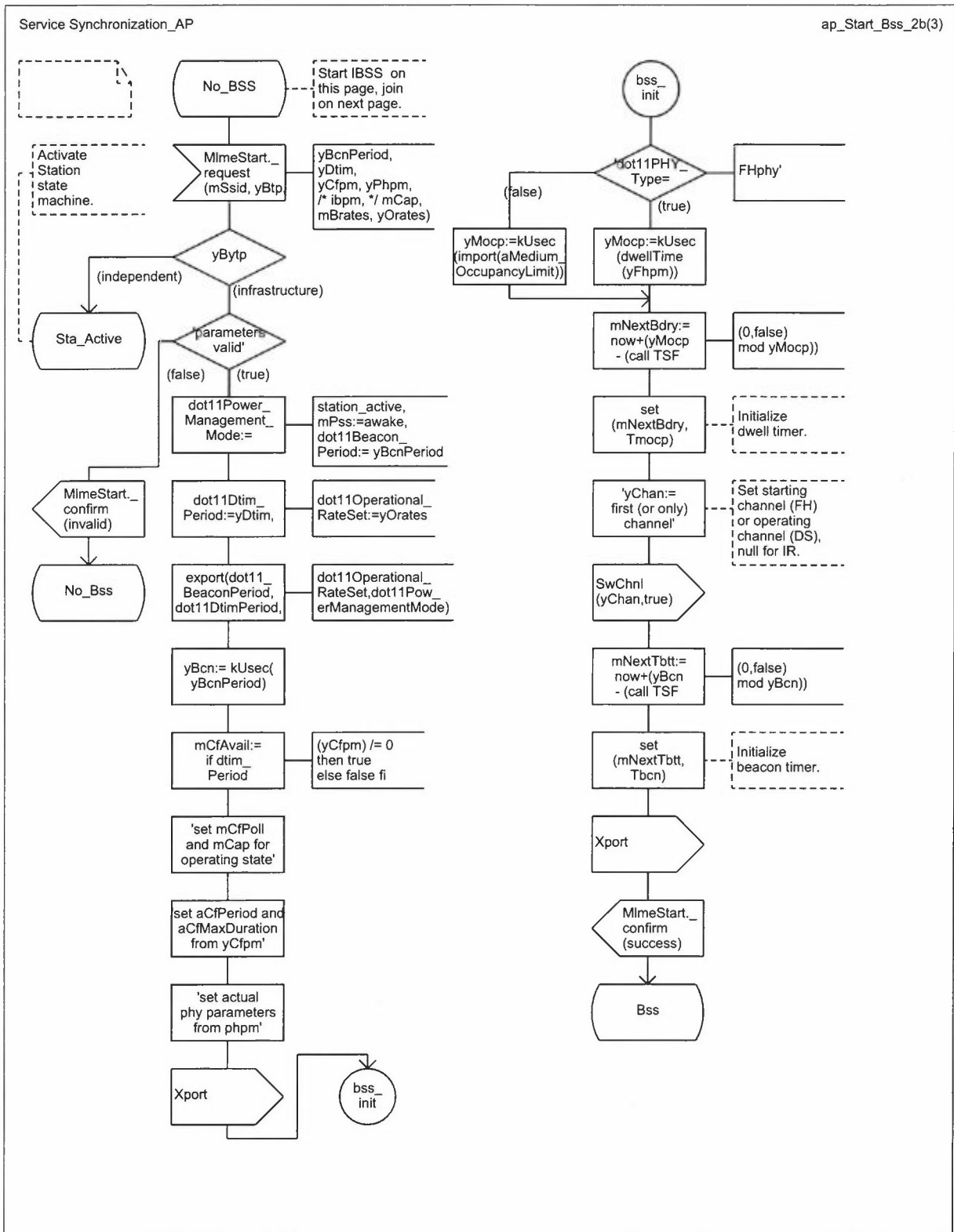


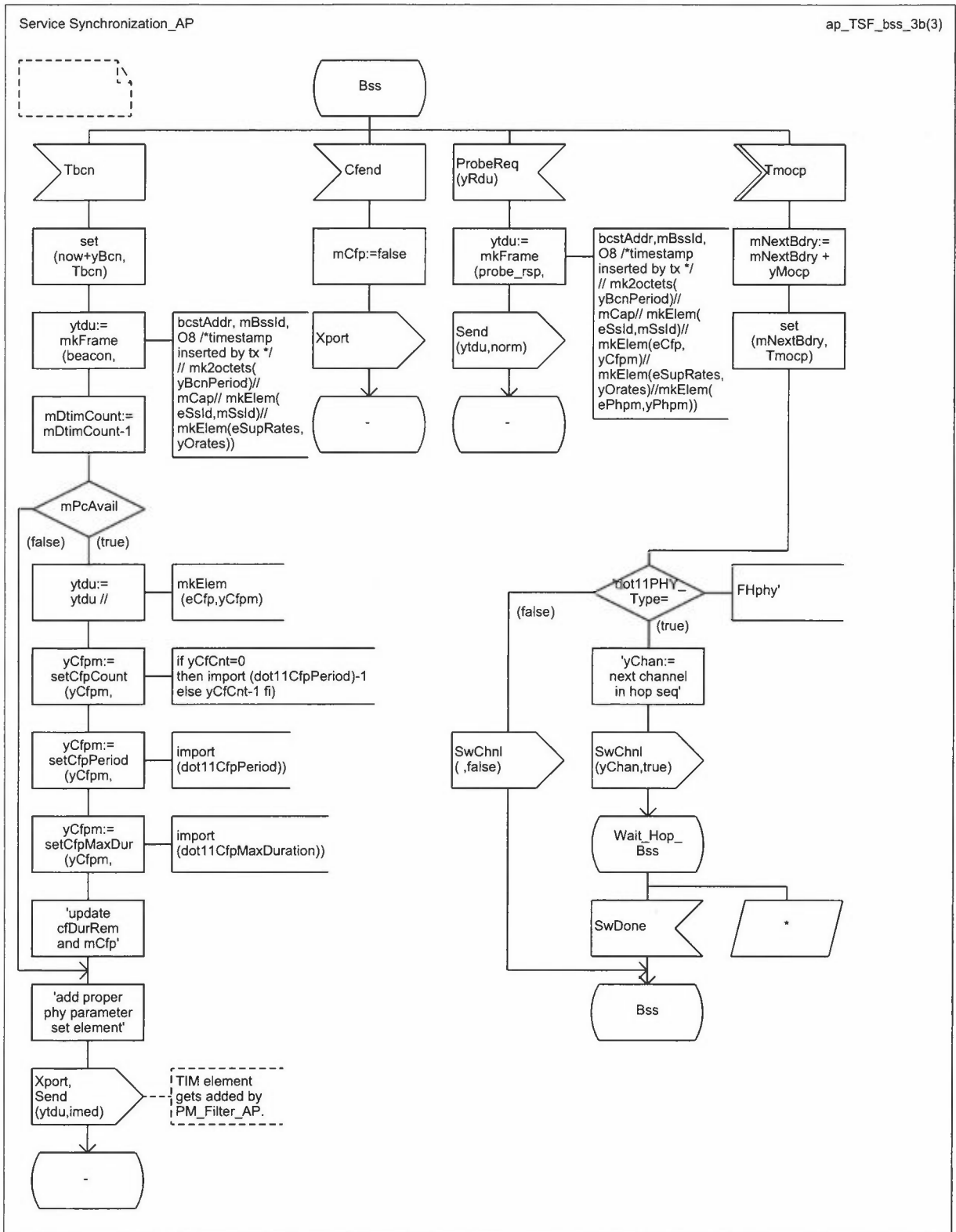
Service Distribute_Mmpdus

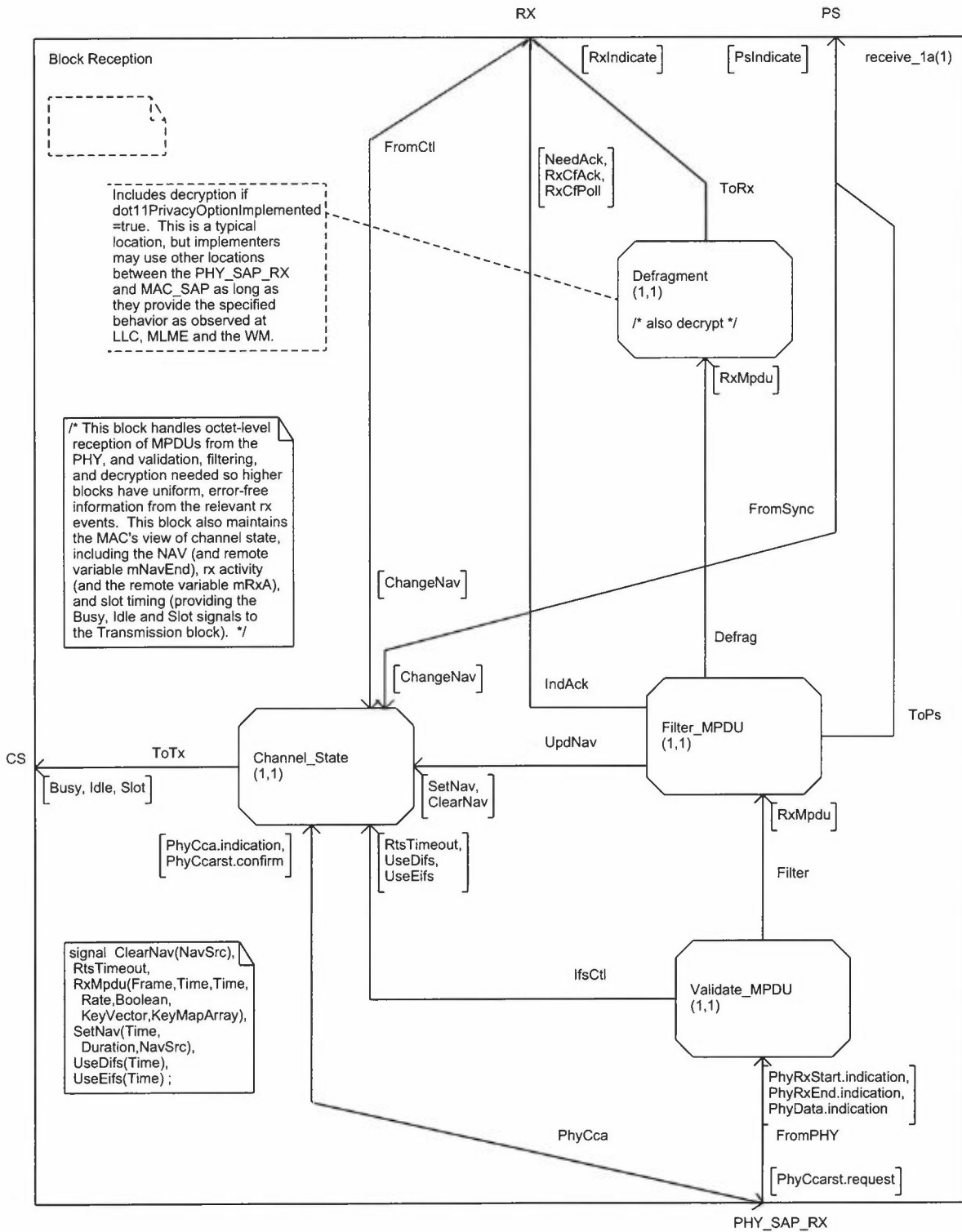
mmpdu_svc_1.1b(2)

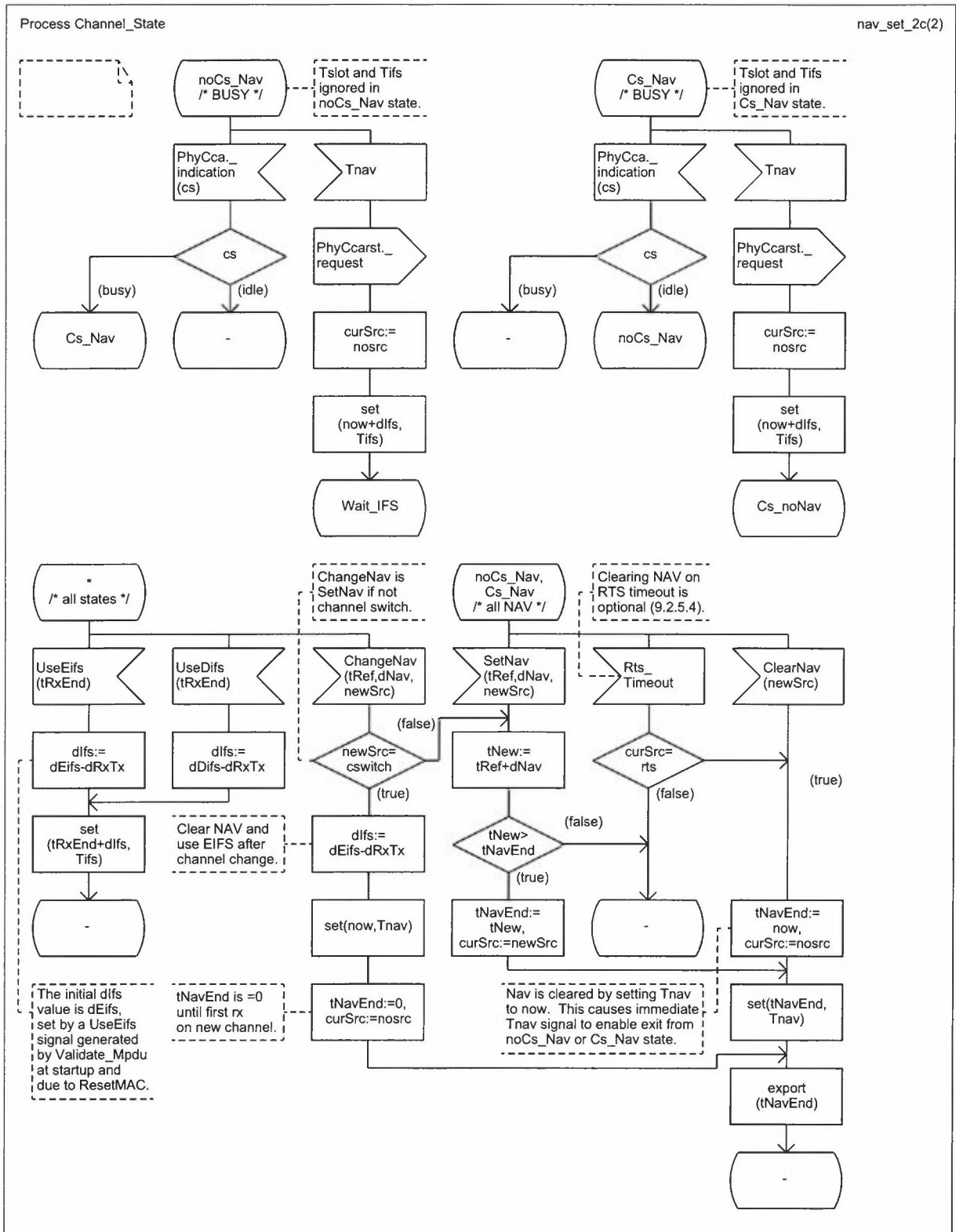


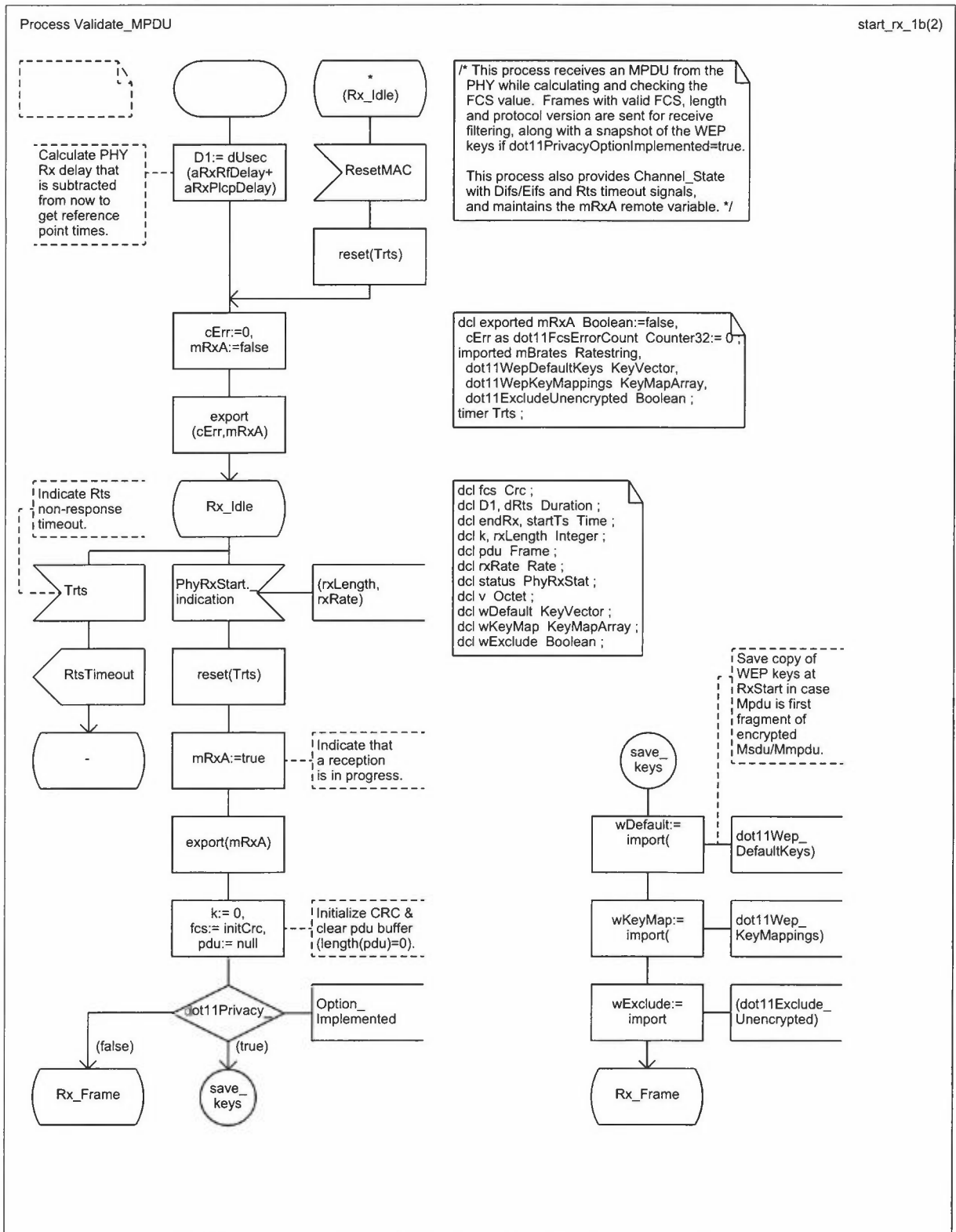


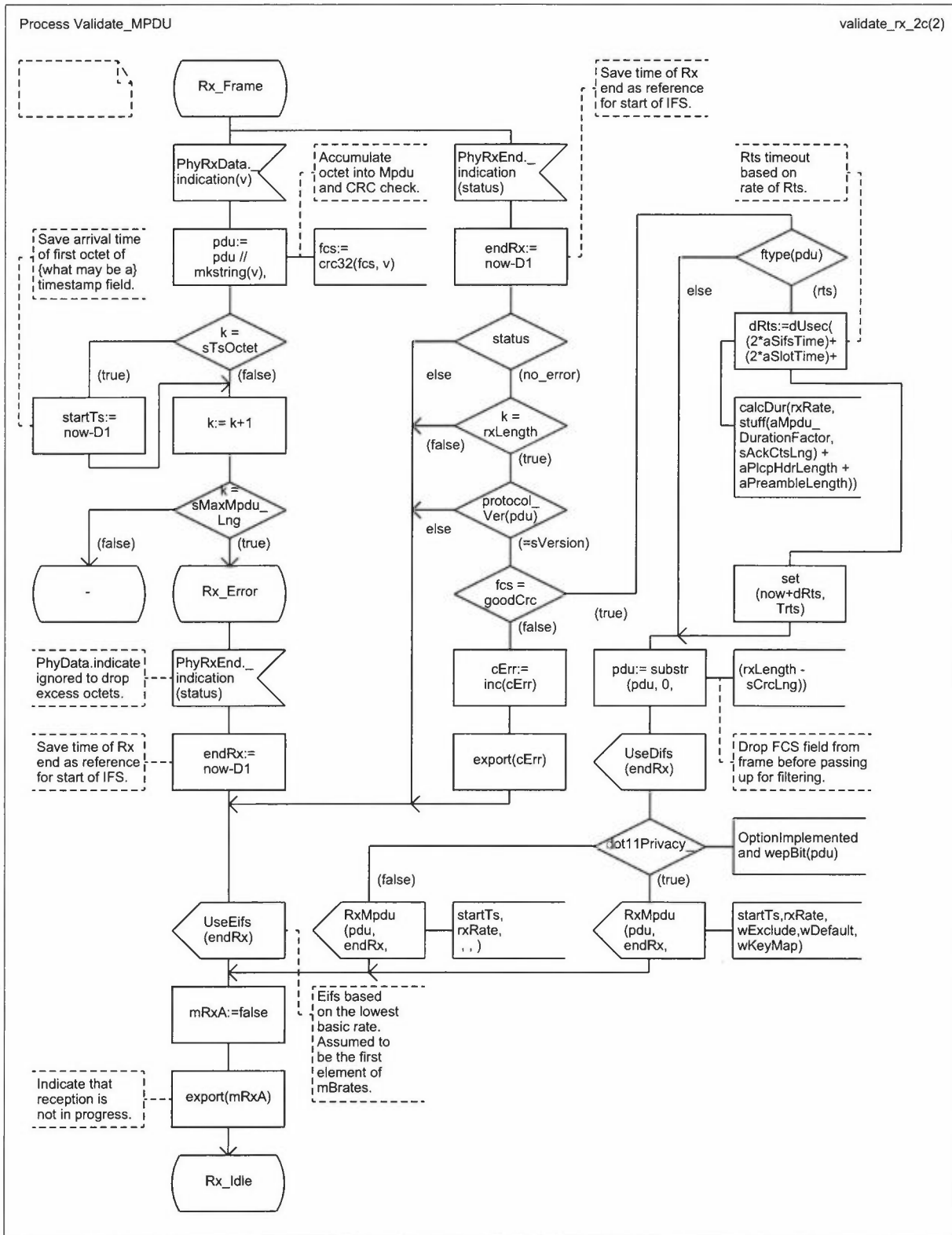


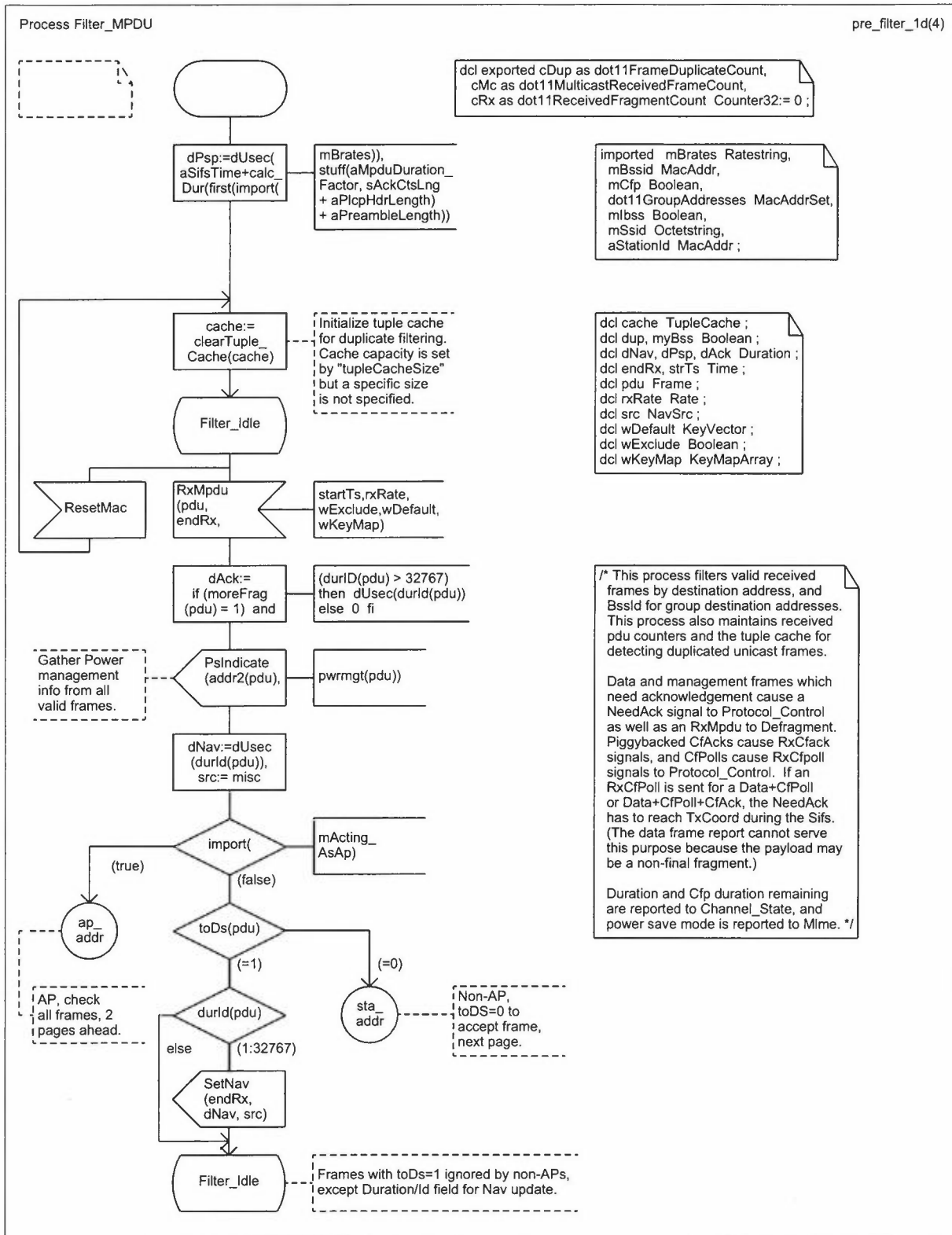


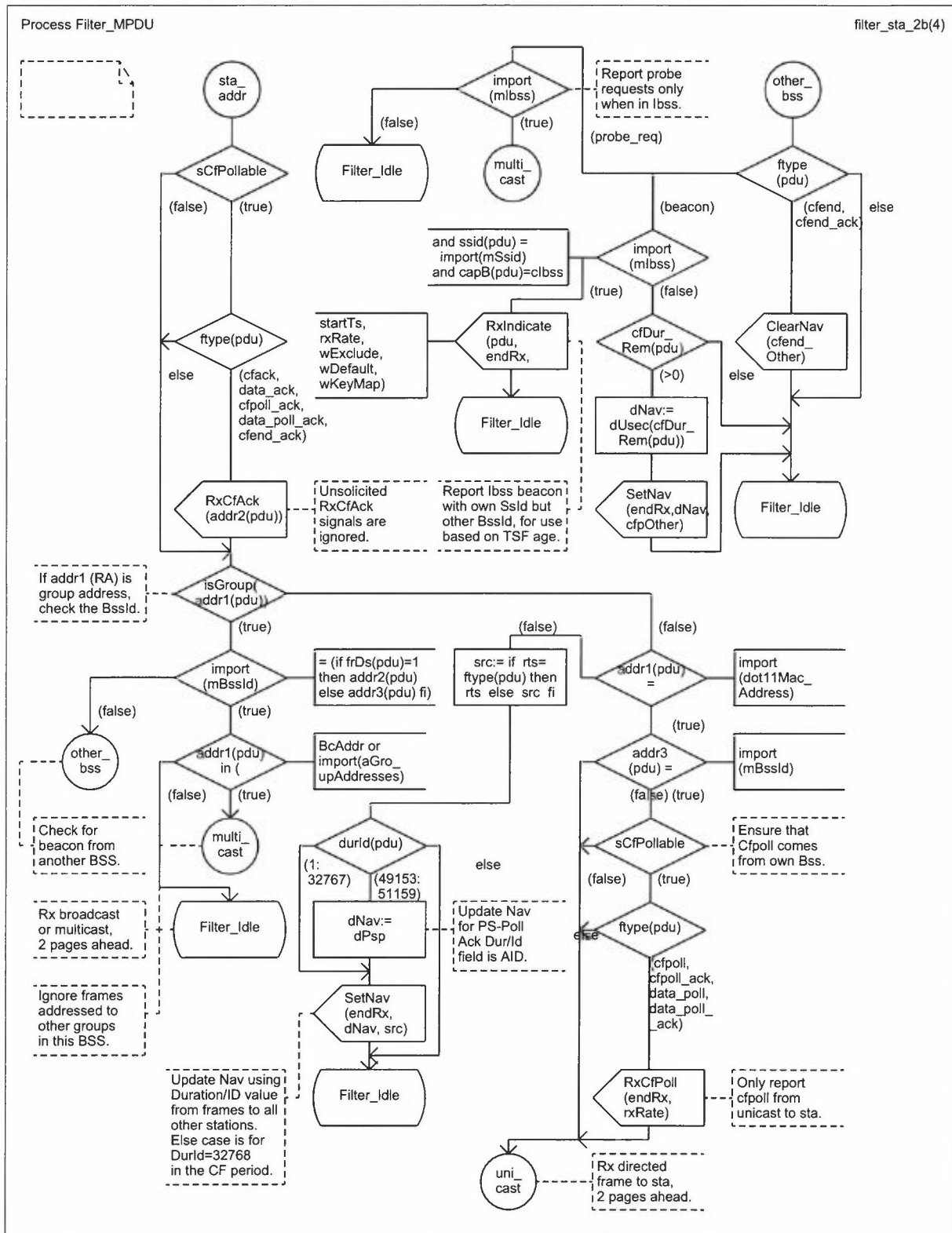


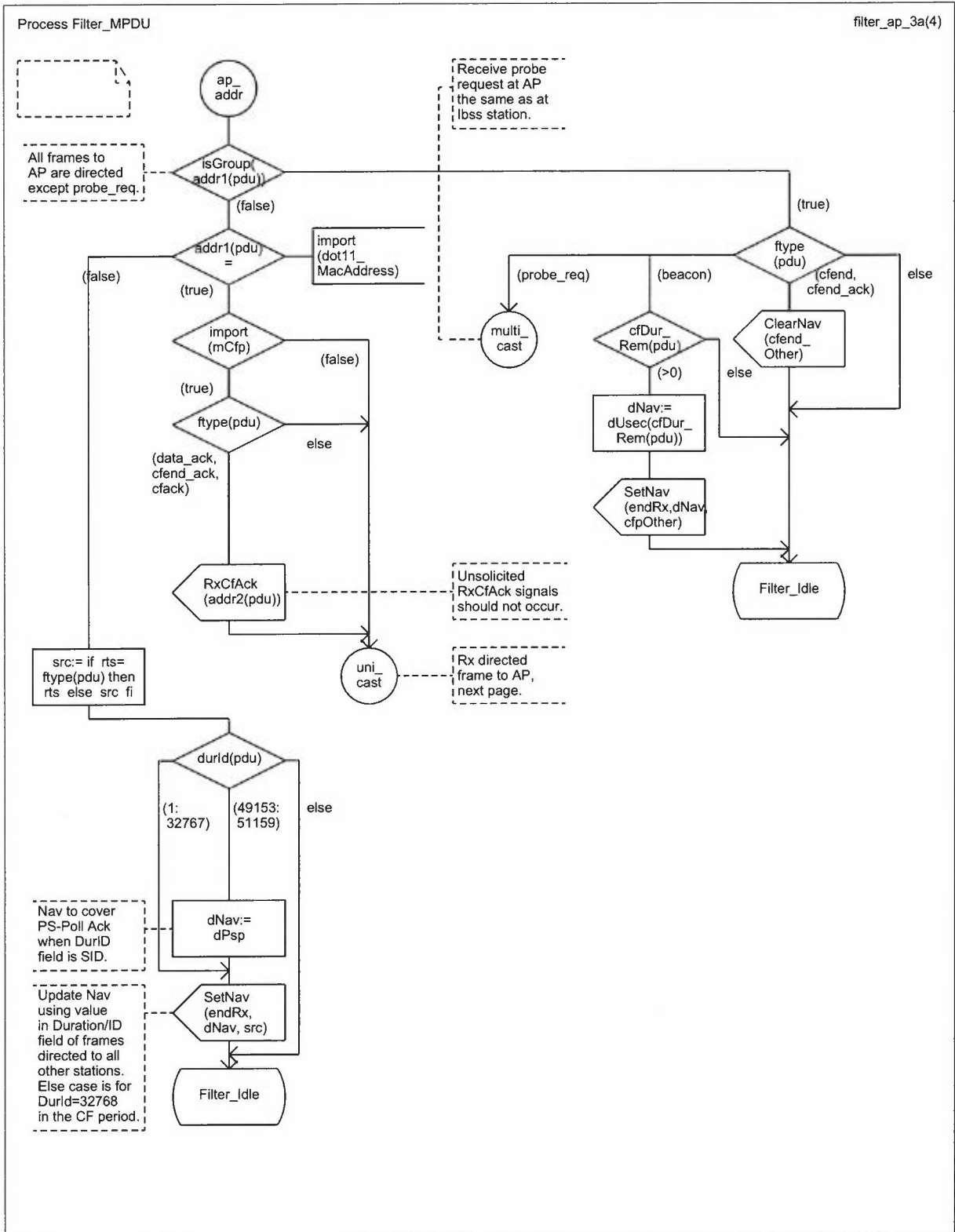


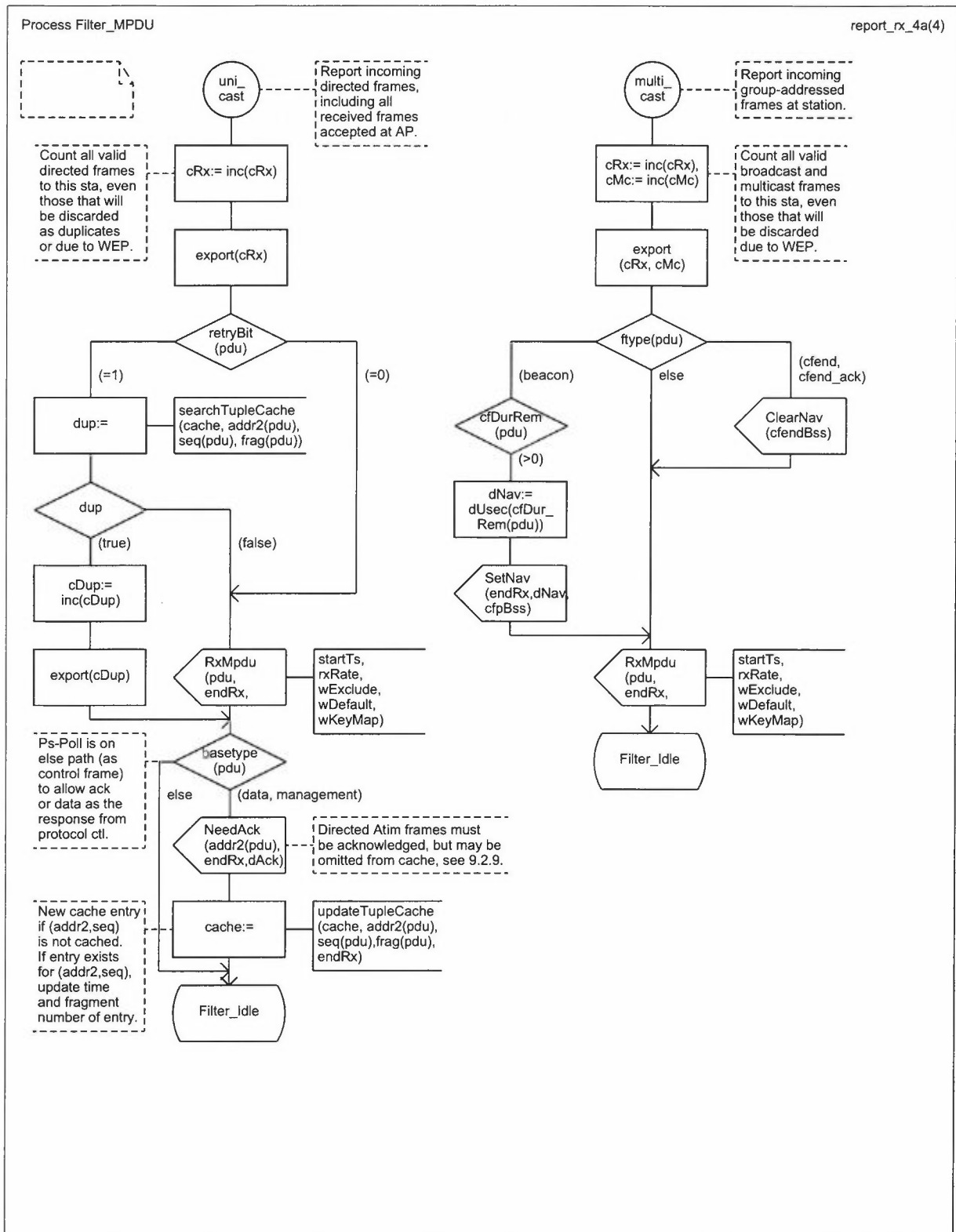


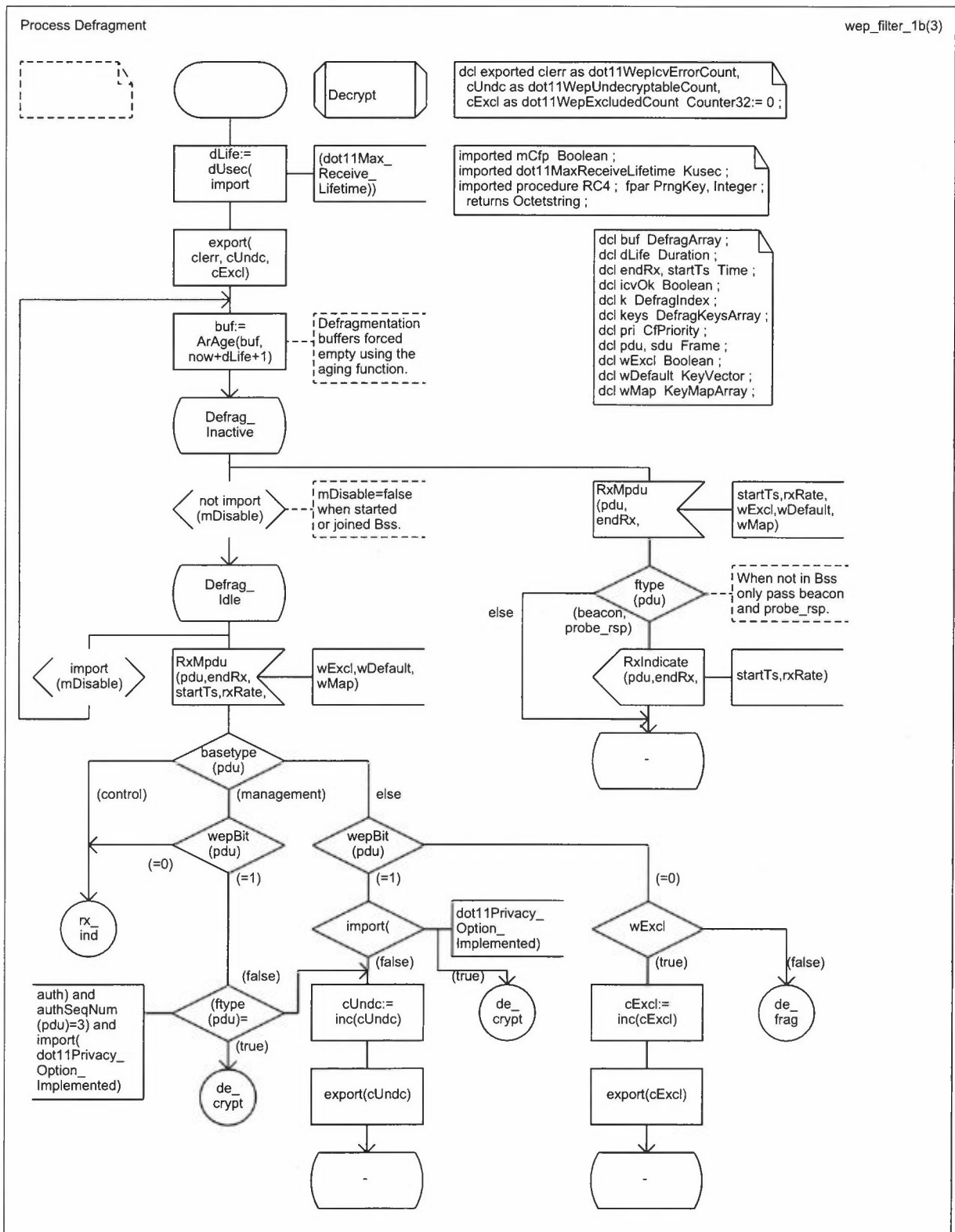


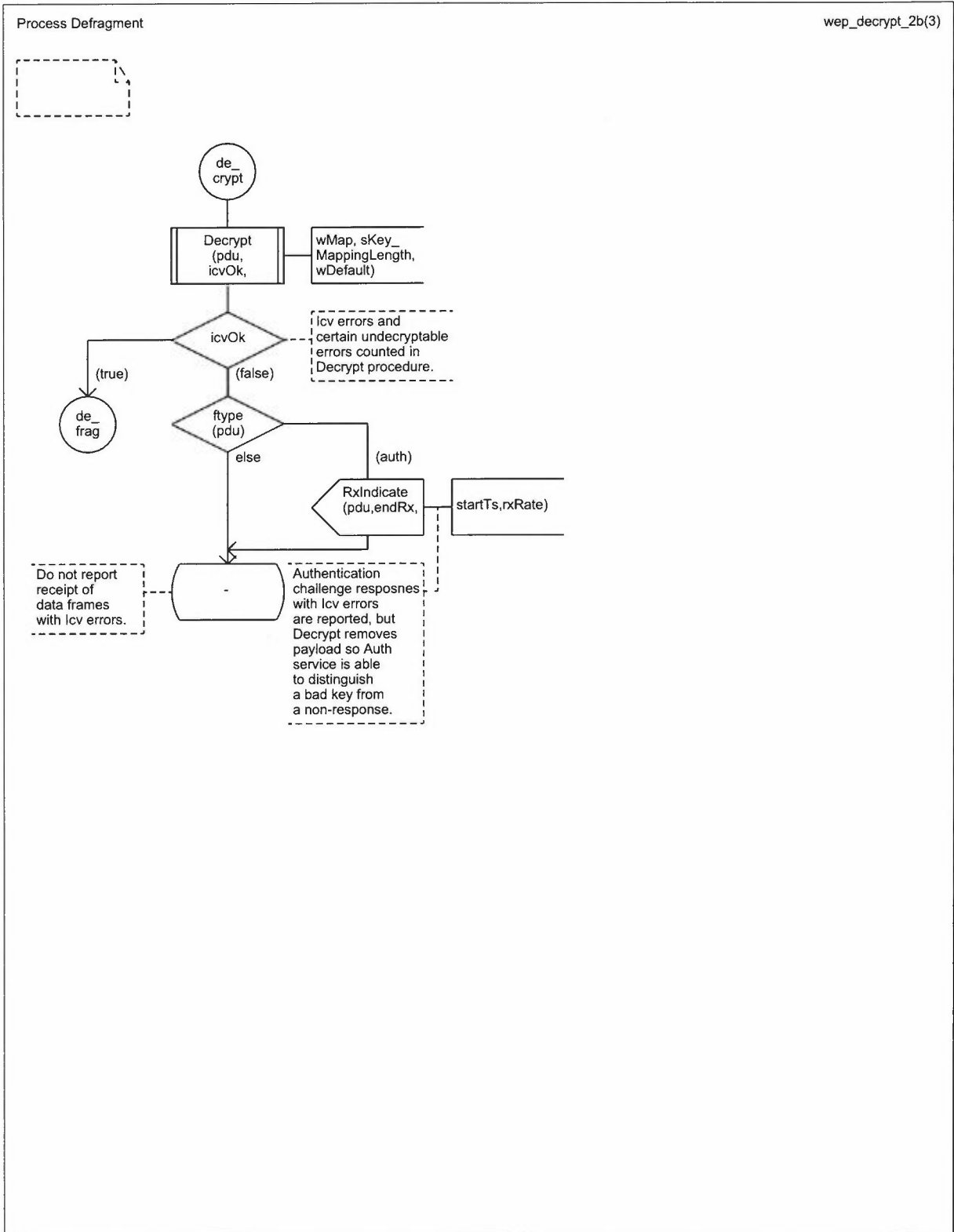


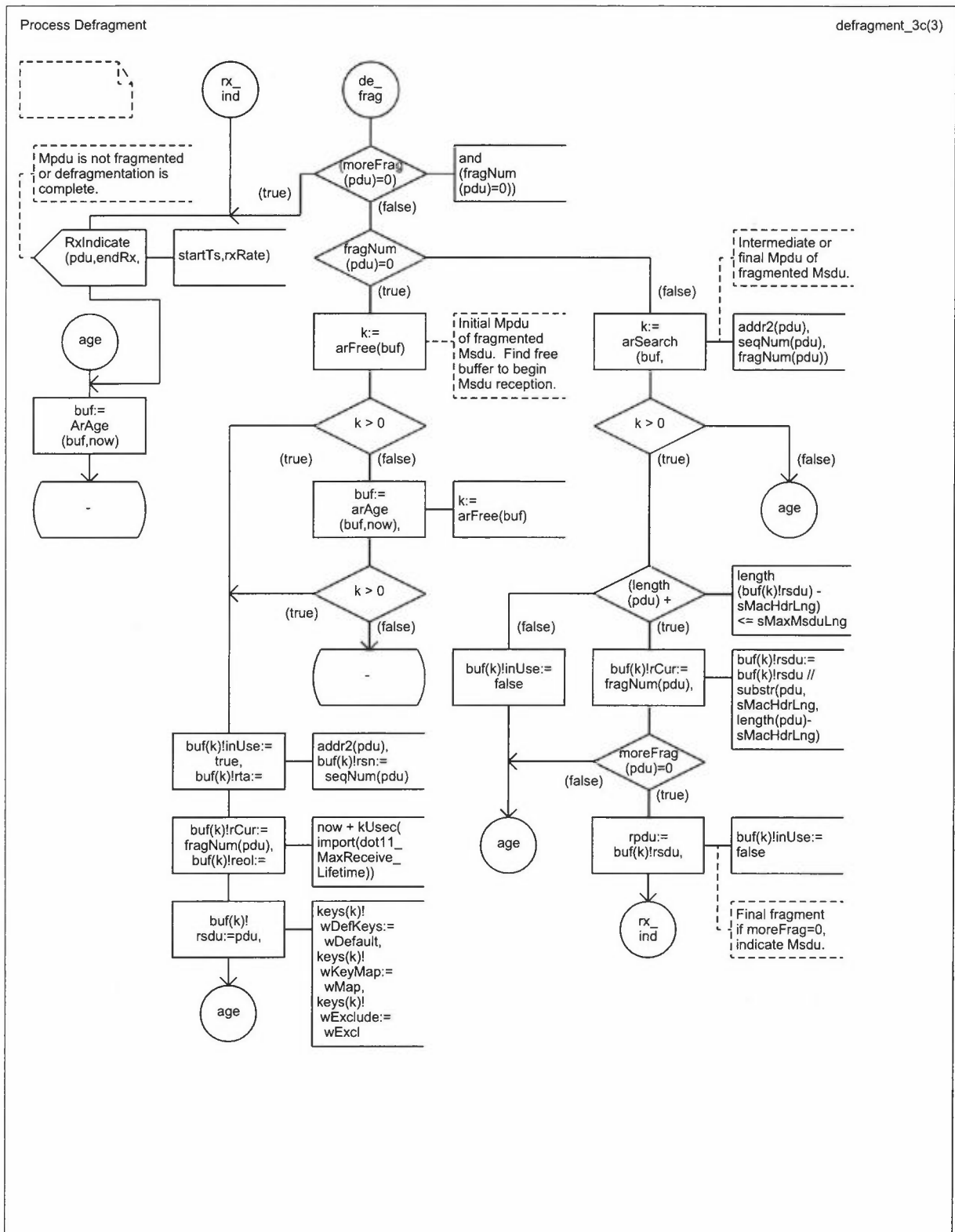


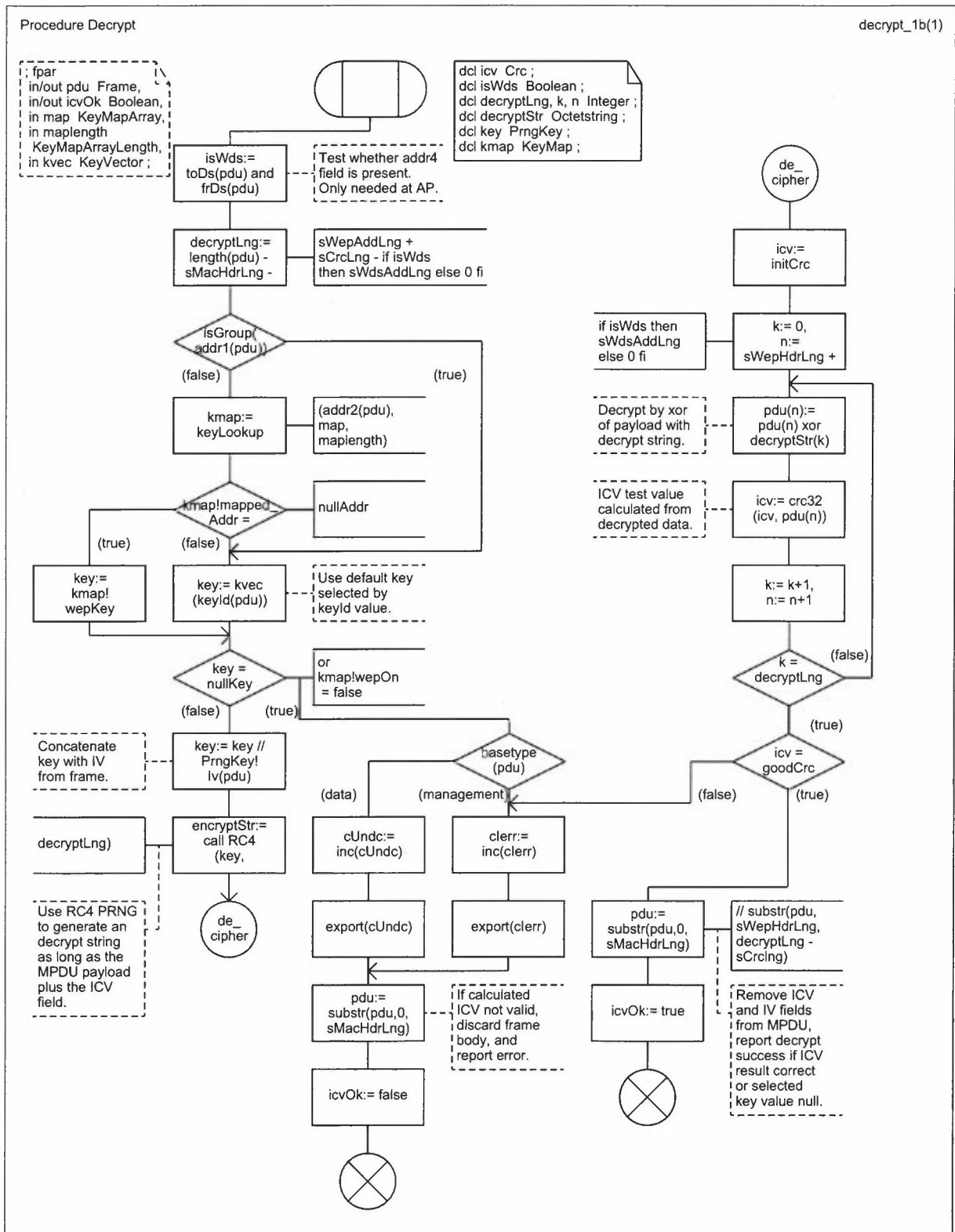












Annex D

(normative)

ASN.1 encoding of the MAC and PHY MIB

```
-- *****
-- * IEEE 802.11 Management Information Base
-- *****
IEEE802dot11-MIB DEFINITIONS ::= BEGIN
    IMPORTS
        MODULE-IDENTITY, OBJECT-TYPE,
        NOTIFICATION-TYPE, Integer32, Counter32 FROM SNMPv2-SMI
        DisplayString , MacAddress, RowStatus,
        TruthValue FROM SNMPv2-TC
        MODULE-COMPLIANCE, OBJECT-GROUP,
        NOTIFICATION-GROUP FROM SNMPv2-CONF
        ifIndex FROM RFC1213-MIB;

-- *****
-- * MODULE IDENTITY
-- *****
ieee802dot11 MODULE-IDENTITY
    LAST-UPDATED "980708000Z"
    ORGANIZATION "IEEE 802.11"
    CONTACT-INFO
        "WG E-mail: stds-802-11@ieee.org

        Chair: Vic Hayes
        Postal: Lucent Technologies, Inc.
                Zadelstede 1-10
                Nieuwegein, Netherlands
                3431 JZ
        Tel: +31 30 609 7528
        Fax: +31 30 231 6233
        E-mail: vichayes@lucent.com

        Editor: Bob O'Hara
        Postal: Informed Technology, Inc.
                1750 Nantucket Circle, Suite 138
                Santa Clara, CA 95054 USA
        Tel: +1 408 986 9596
        Fax: +1 408 727 2654
        E-mail: bob@informed-technology.com"

    DESCRIPTION
        "The MIB module for IEEE 802.11 entities.
        iso(1).member-body(2).us(840).ieee802dot11(10036)"
        ::= { 1 2 840 10036 }

-- *****
-- * Major sections
-- *****
-- Station Management (SMT) Attributes
--   DEFINED AS "The SMT object class provides the necessary support at the
--   station to manage the processes in the station such that the
--   station may work cooperatively as a part of an IEEE 802.11 network.";
```

```

dot11smt OBJECT IDENTIFIER ::= {ieee802dot11 1}

-- dot11smt GROUPS
-- dot11StationConfigTable ::= {dot11smt 1}
-- dot11AuthenticationAlgorithmsTable ::= {dot11smt 2}
-- dot11WEPDefaultKeysTable ::= {dot11smt 3}
-- dot11WEPKeyMappingsTable ::= {dot11smt 4}
-- dot11PrivacyTable ::= {dot11smt 5}
-- dot11SMTnotification ::= {dot11smt 6}

-- MAC Attributes
-- DEFINED AS "The MAC object class provides the necessary support
-- for the access control, generation, and verification of frame check
-- sequences, and proper delivery of valid data to upper layers.;"

dot11mac OBJECT IDENTIFIER ::= {ieee802dot11 2}

-- MAC GROUPS
-- reference IEEE Std 802.1F-1993
-- dot11OperationTable ::= {dot11mac 1}
-- dot11CountersTable ::= {dot11mac 2}
-- dot11GroupAddressesTable ::= {dot11mac 3}

-- Resource Type ID
dot11res OBJECT IDENTIFIER ::= {ieee802dot11 3}
dot11resAttribute OBJECT IDENTIFIER ::= {dot11res 1}

-- PHY Attributes
-- DEFINED AS "The PHY object class provides the necessary support
-- for required PHY operational information that may vary from PHY
-- to PHY and from STA to STA to be communicated to upper layers."

dot11phy OBJECT IDENTIFIER ::= {ieee802dot11 4}

-- phy GROUPS
-- dot11PhyOperationTable ::= {dot11phy 1}
-- dot11PhyAntennaTable ::= {dot11phy 2}
-- dot11PhyTxPowerTable ::= {dot11phy 3}
-- dot11PhyFHSSTable ::= {dot11phy 4}
-- dot11PhyDSSSTable ::= {dot11phy 5}
-- dot11PhyIRTable ::= {dot11phy 6}
-- dot11RegDomainsSupportedTable ::= {dot11phy 7}
-- dot11AntennasListTable ::= {dot11phy 8}
-- dot11SupportedDataRatesTxTable ::= {dot11phy 9}
-- dot11SupportedDataRatesRxTable ::= {dot11phy 10}

-- *****
-- * Textual conventions from 802 definitions
-- *****
WEPKeytype ::= OCTET STRING (SIZE (5))

-- *****
-- * MIB attribute OBJECT-TYPE definitions follow
-- *****

-- *****
-- * SMT Station Config Table
-- *****
dot11StationConfigTable OBJECT-TYPE

```

SYNTAX SEQUENCE OF Dot11StationConfigEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Station Configuration attributes. In tabular form to allow for multiple instances on an agent."

::= { dot11smt 1 }

dot11StationConfigEntry OBJECT-TYPE

SYNTAX Dot11StationConfigEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the dot11StationConfigTable. It is possible for there to be multiple IEEE 802.11 interfaces on one agent, each with its unique MAC address. The relationship between an IEEE 802.11 interface and an interface in the context of the Internet-standard MIB is one-to-one. As such, the value of an ifIndex object instance can be directly used to identify corresponding instances of the objects defined herein.

ifIndex - Each 802.11 interface is represented by an ifEntry. Interface tables in this MIB module are indexed by ifIndex."

INDEX {ifIndex}

::= { dot11StationConfigTable 1 }

Dot11StationConfigEntry ::=

SEQUENCE {

dot11StationID	MacAddress,
dot11MediumOccupancyLimit	INTEGER,
dot11CFPollable	TruthValue,
dot11CFPPeriod	INTEGER,
dot11CFPMaxDuration	INTEGER,
dot11AuthenticationResponseTimeOut	INTEGER,
dot11PrivacyOptionImplemented	TruthValue,
dot11PowerManagementMode	INTEGER,
dot11DesiredSSID	OCTET STRING,
dot11DesiredBSSType	INTEGER,
dot11OperationalRateSet	OCTET STRING,
dot11BeaconPeriod	INTEGER,
dot11DTIMPeriod	INTEGER,
dot11AssociationResponseTimeOut	INTEGER,
dot11DisassociateReason	INTEGER,
dot11DisassociateStation	MacAddress,
dot11DeauthenticateReason	INTEGER,
dot11DeauthenticateStation	MacAddress,
dot11AuthenticateFailStatus	INTEGER,
dot11AuthenticateFailStation	MacAddress }

dot11StationID OBJECT-TYPE

SYNTAX MacAddress

MAX-ACCESS read-write

STATUS deprecated

DESCRIPTION

"The purpose of dot11StationID is to allow a manager to identify

a station for its own purposes. This attribute provides for that eventuality while keeping the true MAC address independent. Its syntax is MacAddress. The default value is the station's assigned, unique MAC address."

```
 ::= { dot11StationConfigEntry 1 }

dot11MediumOccupancyLimit OBJECT-TYPE
    SYNTAX INTEGER (0..1000)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "This attribute shall indicate the maximum amount of time,
        in TU, that a point coordinator may control the usage of
        the wireless medium without relinquishing control for long
        enough to allow at least one instance of DCF access to the
        medium. The default value of this attribute shall be 100,
        and the maximum value shall be 1000."

 ::= { dot11StationConfigEntry 2 }

dot11CFPollable OBJECT-TYPE
    SYNTAX TruthValue
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "When this attribute is true, it shall indicate that the STA
        is able to respond to a CF-Poll with a data frame within a
        SIFS time. This attribute shall be false if the STA is not
        able to respond to a CF-Poll with a data frame within a SIFS
        time."

 ::= { dot11StationConfigEntry 3 }

dot11CFPPeriod OBJECT-TYPE
    SYNTAX INTEGER (0..255)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The attribute shall describe the number of DTIM intervals
        between the start of CFPs. It is modified by
        MLME-START.request primitive."

 ::= { dot11StationConfigEntry 4 }

dot11CFPMaxDuration OBJECT-TYPE
    SYNTAX INTEGER (0..65535)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The attribute shall describe the maximum duration of the CFP
        in TU that may be generated by the PCF. It is modified by
        MLME-START.request primitive."

 ::= { dot11StationConfigEntry 5 }

dot11AuthenticationResponseTimeOut OBJECT-TYPE
    SYNTAX INTEGER (1..4294967295)
    MAX-ACCESS read-write
    STATUS current
```

DESCRIPTION

"This attribute shall specify the number of TUs that a responding STA should wait for the next frame in the authentication sequence."

```
::= { dot11StationConfigEntry 6 }
```

dot11PrivacyOptionImplemented OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This attribute, when true, shall indicate that the IEEE 802.11 WEP option is implemented. The default value of this attribute shall be false."

```
::= { dot11StationConfigEntry 7 }
```

dot11PowerManagementMode OBJECT-TYPE

SYNTAX INTEGER { active(1), powersave(2) }

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This attribute shall specify the power management mode of the STA. When set to active, it shall indicate that the station is not in power-save mode. When set to powersave, it shall indicate that the station is in power-save mode. The power management mode is transmitted in all frames according to the rules in 7.1.3.1.7."

```
::= { dot11StationConfigEntry 8 }
```

dot11DesiredSSID OBJECT-TYPE

SYNTAX OCTET STRING (SIZE(0..32))

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This attribute reflects the Service Set ID used in the DesiredSSID parameter of the most recent MLME_Scan.request. This value may be modified by an external management entity and used by the local SME to make decisions about the Scanning process."

```
::= { dot11StationConfigEntry 9 }
```

dot11DesiredBSSType OBJECT-TYPE

SYNTAX INTEGER { infrastructure(1), independent(2), any(3) }

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This attribute shall specify the type of BSS the station shall use when scanning for a BSS with which to synchronize. This value is used to filter Probe Response frames and Beacons. When set to infrastructure, the station shall only synchronize with a BSS whose Capability Information field has the ESS subfield set to 1. When set to independent, the station shall only synchronize with a BSS whose Capability Information field has the IBSS subfield set to 1. When set to any, the station may synchronize to either type of

```

        BSS."
 ::= { dot11StationConfigEntry 10 }

dot11OperationalRateSet OBJECT-TYPE
    SYNTAX OCTET STRING (SIZE(1..126))
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "This attribute shall specify the set of data rates
        at which the station may transmit data. Each octet
        contains a value representing a rate. Each rate
        shall be within the range from 2 to 127,
        corresponding to data rates in increments of
        500 kb/s from 1 Mbit/s to 63.5 Mbit/s, and shall be
        supported (as indicated in the supported rates
        table) for receiving data. This value is reported in
        transmitted Beacon, Probe Request, Probe Response,
        Association Request, Association Response,
        Reassociation Request, and Reassociation Response
        frames, and is used to determine whether a BSS
        with which the station desires to synchronize is
        suitable. It is also used when starting a BSS,
        as specified in 10.3."
 ::= { dot11StationConfigEntry 11 }

dot11BeaconPeriod OBJECT-TYPE
    SYNTAX INTEGER (1..65535)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "This attribute shall specify the number of TUs that a
        station shall use for scheduling Beacon transmissions.
        This value is transmitted in Beacon and Probe Response
        frames."
 ::= { dot11StationConfigEntry 12 }

dot11DTIMPeriod OBJECT-TYPE
    SYNTAX INTEGER(1..255)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "This attribute shall specify the number of beacon
        intervals that shall elapse between transmission of
        Beacons frames containing a TIM element whose DTIM
        Count field is 0. This value is transmitted in
        the DTIM Period field of Beacon frames."
 ::= { dot11StationConfigEntry 13 }

dot11AssociationResponseTimeOut OBJECT-TYPE
    SYNTAX INTEGER(1..4294967295)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "This attribute shall specify the number of TUs that a
        requesting STA should wait for a response to a
        transmitted association-request MMPDU."
 ::= { dot11StationConfigEntry 14 }

dot11DisassociateReason OBJECT-TYPE

```

SYNTAX INTEGER(0..65535)
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "This attribute holds the most recently transmitted Reason Code in a Disassociation frame. If no Disassociation frame has been transmitted, the value of this attribute shall be 0."

REFERENCE "ISO/IEC 8802-11:1999, 7.3.1.7"
 ::= { dot11StationConfigEntry 15 }

dot11DisassociateStation OBJECT-TYPE
 SYNTAX MacAddress
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "This attribute holds the MAC address from the Address 1 field of the most recently transmitted Disassociation frame. If no Disassociation frame has been transmitted, the value of this attribute shall be 0."
 ::= { dot11StationConfigEntry 16 }

dot11DeauthenticateReason OBJECT-TYPE
 SYNTAX INTEGER(0..65535)
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "This attribute holds the most recently transmitted Reason Code in a Deauthentication frame. If no Deauthentication frame has been transmitted, the value of this attribute shall be 0."

REFERENCE "ISO/IEC 8802-11:1999, 7.3.1.7"
 ::= { dot11StationConfigEntry 17 }

dot11DeauthenticateStation OBJECT-TYPE
 SYNTAX MacAddress
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "This attribute holds the MAC address from the Address 1 field of the most recently transmitted Deauthentication frame. If no Deauthentication frame has been transmitted, the value of this attribute shall be 0."
 ::= { dot11StationConfigEntry 18 }

dot11AuthenticateFailStatus OBJECT-TYPE
 SYNTAX INTEGER(0..65535)
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "This attribute holds the most recently transmitted Status Code in a failed Authentication frame. If no failed Authentication frame has been transmitted, the value of this attribute shall be 0."

REFERENCE "ISO/IEC 8802-11:1999, 7.3.1.9"

```

 ::= { dot11StationConfigEntry 19 }

dot11AuthenticateFailStation OBJECT-TYPE
    SYNTAX MacAddress
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "This attribute holds the MAC address from the
        Address 1 field of the most recently transmitted
        failed Authentication frame. If no failed Authentication
        frame has been transmitted, the value of this attribute
        shall be 0."
 ::= { dot11StationConfigEntry 20 }

-- *****
-- *      End of dot11StationConfig TABLE
-- *****

-- *****
-- *      AuthenticationAlgorithms TABLE
-- *****
dot11AuthenticationAlgorithmsTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11AuthenticationAlgorithmsEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "This (conceptual) table of attributes shall be a set of
        all the authentication algorithms supported by the
        stations. The following are the default values and the
        associated algorithm:
            Value = 1: Open System
            Value = 2: Shared Key"
    REFERENCE "ISO/IEC 8802-11:1999, 7.3.1.1"
 ::= { dot11smt 2 }

dot11AuthenticationAlgorithmsEntry OBJECT-TYPE
    SYNTAX Dot11AuthenticationAlgorithmsEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "An Entry (conceptual row) in the Authentication
        Algorithms Table.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry. Interface tables in this MIB module are indexed
        by ifIndex."

    INDEX { ifIndex,
            dot11AuthenticationAlgorithmsIndex }
 ::= { dot11AuthenticationAlgorithmsTable 1 }

Dot11AuthenticationAlgorithmsEntry ::= SEQUENCE {
    dot11AuthenticationAlgorithmsIndex          Integer32,
    dot11AuthenticationAlgorithm                INTEGER,
    dot11AuthenticationAlgorithmsEnable        TruthValue }

dot11AuthenticationAlgorithmsIndex OBJECT-TYPE
    SYNTAX Integer32

```



```

MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    "The auxiliary variable used to identify instances
    of the columnar objects in the Authentication Algorithms Table."
 ::= { dot11AuthenticationAlgorithmsEntry 1 }

dot11AuthenticationAlgorithm OBJECT-TYPE
    SYNTAX INTEGER { openSystem (1), sharedKey (2) }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "This attribute shall be a set of all the authentication
        algorithms supported by the STAs. The following are the
        default values and the associated algorithm.
        Value = 1: Open System
        Value = 2: Shared Key"
 ::= { dot11AuthenticationAlgorithmsEntry 2 }

dot11AuthenticationAlgorithmsEnable OBJECT-TYPE
    SYNTAX TruthValue
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "This attribute, when true at a station,
        shall enable the acceptance of the authentication
        algorithm described in the corresponding table
        entry in authentication frames received by the
        station that have odd authentication sequence numbers.
        The default value of this attribute shall be 1 for
        the Open System table entry and 2 for all other table entries."
 ::= { dot11AuthenticationAlgorithmsEntry 3 }

-- *****
-- *      End of AuthenticationAlgorithms TABLE
-- *****

-- *****
-- *      WEPDefaultKeys TABLE
-- *****

dot11WEPDefaultKeysTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11WEPDefaultKeysEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Conceptual table for WEP default keys. This table shall
        contain the four WEP default secret key values
        corresponding to the four possible KeyID values. The WEP
        default secret keys are logically WRITE-ONLY. Attempts to
        read the entries in this table shall return unsuccessful
        status and values of null or zero. The default value of
        each WEP default key shall be null."

    REFERENCE "ISO/IEC 8802-11:1999, 8.3.2"
 ::= { dot11smt 3 }

dot11WEPDefaultKeysEntry OBJECT-TYPE

```

```

SYNTAX Dot11WEPDefaultKeysEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    "An Entry (conceptual row) in the WEP Default Keys Table.

    ifIndex - Each 802.11 interface is represented by an
    ifEntry. Interface tables in this MIB module are indexed
    by ifIndex."

    INDEX {ifIndex, dot11WEPDefaultKeyIndex}
 ::= { dot11WEPDefaultKeysTable 1 }

Dot11WEPDefaultKeysEntry ::= SEQUENCE {
    dot11WEPDefaultKeyIndex    INTEGER,
    dot11WEPDefaultKeyValue    WEPKeytype}

dot11WEPDefaultKeyIndex OBJECT-TYPE
    SYNTAX INTEGER (1..4)
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The auxiliary variable used to identify instances
        of the columnar objects in the WEP Default Keys Table.
        The value of this variable is equal to the WEPDefaultKeyID + 1"
 ::= { dot11WEPDefaultKeysEntry 1 }

dot11WEPDefaultKeyValue OBJECT-TYPE
    SYNTAX WEPKeytype
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "A WEP default secret key value."
 ::= { dot11WEPDefaultKeysEntry 2 }

-- *****
-- *      End of WEPDefaultKeys  TABLE
-- *****

-- *****
-- *      WEPKeyMappings  TABLE
-- *****

dot11WEPKeyMappingsTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11WEPKeyMappingsEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Conceptual table for WEP Key Mappings. The MIB supports
        the ability to share a separate WEP key for each RA/TA
        pair. The Key Mappings Table contains zero or one entry
        for each MAC address and contains two fields for each
        entry: WEPOn and the corresponding WEP key. The WEP key
        mappings are logically WRITE-ONLY. Attempts to read the
        entries in this table shall return unsuccessful status and
        values of null or zero. The default value for all WEPOn
        fields is false."
    REFERENCE "ISO/IEC 8802-11:1999, 8.3.2"
 ::= { dot11smt 4 }

```

```

dot11WEPKeyMappingsEntry OBJECT-TYPE
    SYNTAX Dot11WEPKeyMappingsEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "An Entry (conceptual row) in the WEP Key Mappings Table.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry. Interface tables in this MIB module are indexed
        by ifIndex."

    INDEX {ifIndex, dot11WEPKeyMappingIndex}
    ::= { dot11WEPKeyMappingsTable 1 }

Dot11WEPKeyMappingsEntry ::= SEQUENCE {
    dot11WEPKeyMappingIndex          Integer32,
    dot11WEPKeyMappingAddress       MacAddress,
    dot11WEPKeyMappingWEPOn        TruthValue,
    dot11WEPKeyMappingValue        WEPKeytype,
    dot11WEPKeyMappingStatus       RowStatus }

dot11WEPKeyMappingIndex OBJECT-TYPE
    SYNTAX Integer32
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The auxiliary variable used to identify instances
        of the columnar objects in the WEP Key Mappings Table."
    ::= { dot11WEPKeyMappingsEntry 1 }

dot11WEPKeyMappingAddress OBJECT-TYPE
    SYNTAX MacAddress
    MAX-ACCESS read-create
    STATUS current
    DESCRIPTION
        "The MAC address of the STA for which the values from this
        key mapping entry are to be used."
    ::= { dot11WEPKeyMappingsEntry 2 }

dot11WEPKeyMappingWEPOn OBJECT-TYPE
    SYNTAX TruthValue
    MAX-ACCESS read-create
    STATUS current
    DESCRIPTION
        "Boolean as to whether WEP is to be used when communicating
        with the dot11WEPKeyMappingAddress STA."
    ::= { dot11WEPKeyMappingsEntry 3 }

dot11WEPKeyMappingValue OBJECT-TYPE
    SYNTAX WEPKeytype
    MAX-ACCESS read-create
    STATUS current
    DESCRIPTION
        "A WEP secret key value."
    ::= { dot11WEPKeyMappingsEntry 4 }

dot11WEPKeyMappingStatus OBJECT-TYPE
    SYNTAX RowStatus
    MAX-ACCESS read-create

```

```

STATUS current
DESCRIPTION
    "The status column used for creating, modifying, and
    deleting instances of the columnar objects in the WEP key
    mapping Table."

    DEFVAL {active}
    ::= { dot11WEPKeyMappingsEntry 5 }

-- *****
-- *      End of WEPKeyMappings TABLE
-- *****

-- *****
-- *      dot11PrivacyTable TABLE
-- *****
dot11PrivacyTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11PrivacyEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Group containing attributes concerned with IEEE 802.11
        Privacy. Created as a table to allow multiple
        instantiations on an agent."

    ::= { dot11smt 5 }

dot11PrivacyEntry OBJECT-TYPE
    SYNTAX Dot11PrivacyEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "An entry in the dot11PrivacyTable Table.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry. Interface tables in this MIB module are indexed
        by ifIndex."
    INDEX {ifIndex}
    ::= { dot11PrivacyTable 1 }

Dot11PrivacyEntry ::= SEQUENCE {
    dot11PrivacyInvoked                TruthValue,
    dot11WEPDefaultKeyID                INTEGER,
    dot11WEPKeyMappingLength            INTEGER,
    dot11ExcludeUnencrypted              TruthValue,
    dot11WEPICVErrorCount                Counter32,
    dot11WEPExcludedCount                Counter32}

dot11PrivacyInvoked OBJECT-TYPE
    SYNTAX TruthValue
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "When this attribute is true, it shall indicate that the IEEE
        802.11 WEP mechanism is used for transmitting frames of type
        Data. The default value of this attribute shall be false."
    ::= { dot11PrivacyEntry 1 }

dot11WEPDefaultKeyID OBJECT-TYPE

```

```

SYNTAX INTEGER (0..3)
MAX-ACCESS read-write
STATUS current
DESCRIPTION
    "This attribute shall indicate the use of the first,
    second, third, or fourth element of the WEPDefaultKeys
    array when set to values of zero, one, two, or three. The
    default value of this attribute shall be 0."
REFERENCE "ISO/IEC 8802-11:1999, 8.3.2"
 ::= { dot11PrivacyEntry 2 }

dot11WEPKeyMappingLength OBJECT-TYPE
    SYNTAX INTEGER (10..4294967295)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The maximum number of tuples that dot11WEPKeyMappings can hold."
    REFERENCE "ISO/IEC 8802-11:1999, 8.3.2"
 ::= { dot11PrivacyEntry 3 }

dot11ExcludeUnencrypted OBJECT-TYPE
    SYNTAX TruthValue
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "When this attribute is true, the STA shall not indicate at
        the MAC service interface received MSDUs that have the WEP
        subfield of the Frame Control field equal to zero. When this
        attribute is false, the STA may accept MSDUs that have the WEP
        subfield of the Frame Control field equal to zero. The default
        value of this attribute shall be false."
 ::= { dot11PrivacyEntry 4 }

dot11WEPICVErrorCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "This counter shall increment when a frame is received with the
        WEP subfield of the Frame Control field set to one and the value
        of the ICV as received in the frame does not match the ICV value
        that is calculated for the contents of the received frame."
 ::= { dot11PrivacyEntry 5 }

dot11WEPExcludedCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "This counter shall increment when a frame is received with the
        WEP subfield of the Frame Control field set to zero and the value
        of dot11ExcludeUnencrypted causes that frame to be discarded."
 ::= { dot11PrivacyEntry 6 }

-- *****
-- *      End of dot11Privacy TABLE
-- *****

```

```

-- *****
-- *      SMT notification Objects
-- *****
dot11SMTnotification OBJECT IDENTIFIER ::= { dot11smt 6 }

dot11Disassociate NOTIFICATION-TYPE
    OBJECTS { ifIndex, dot11DisassociateReason,
dot11DisassociateStation }
    STATUS current
    DESCRIPTION
        "The disassociate notification shall be sent when the STA
        sends a Disassociation frame. The value of the notification
        shall include the MAC address of the MAC to which the
        Disassociation frame was sent and the reason for
        the disassociation.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry. Interface tables in this MIB module are indexed
        by ifIndex."

    ::= { dot11SMTnotification 0 1 }

dot11Deauthenticate NOTIFICATION-TYPE
    OBJECTS { ifIndex, dot11DeauthenticateReason,
dot11DeauthenticateStation }
    STATUS current
    DESCRIPTION
        "The deauthenticate notification shall be sent when the STA
        sends a Deauthentication frame. The value of the notification
        shall include the MAC address of the MAC to which the
        Deauthentication frame was sent and the reason for the
        deauthentication.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry. Interface tables in this MIB module are indexed
        by ifIndex."

    ::= { dot11SMTnotification 0 2 }

dot11AuthenticateFail NOTIFICATION-TYPE
    OBJECTS { ifIndex, dot11AuthenticateFailStatus,
dot11AuthenticateFailStation }
    STATUS current
    DESCRIPTION
        "The authenticate failure notification shall be sent
        when the STA sends an Authentication frame with a
        status code other than 'successful.' The value of
        the notification shall include the MAC address of the
        MAC to which the Authentication frame was sent and the
        reason for the authentication failure.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry. Interface tables in this MIB module are indexed
        by ifIndex."

    ::= { dot11SMTnotification 0 3 }

```

```

-- *****
-- *   End of SMT notification Objects
-- *****

-- *****
-- *   MAC Attribute Templates
-- *****

-- *****
-- *   dot11OperationTable TABLE
-- *****
dot11OperationTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11OperationEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Group contains MAC attributes pertaining to the operation
        of the MAC. This has been implemented as a table in order
        to allow for multiple instantiations on an agent."

    ::= { dot11mac 1 }

dot11OperationEntry OBJECT-TYPE
    SYNTAX Dot11OperationEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "An entry in the dot11OperationEntry Table.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry. Interface tables in this MIB module are indexed
        by ifIndex."
    INDEX {ifIndex}
    ::= { dot11OperationTable 1 }

Dot11OperationEntry ::= SEQUENCE {
    dot11MACAddress          MacAddress,
    dot11RTSThreshold        INTEGER,
    dot11ShortRetryLimit    INTEGER,
    dot11LongRetryLimit     INTEGER,
    dot11FragmentationThreshold  INTEGER,
    dot11MaxTransmitMSDULifetime  INTEGER,
    dot11MaxReceiveLifetime    INTEGER,
    dot11ManufacturerID     DisplayString,
    dot11ProductID          DisplayString}

dot11MACAddress OBJECT-TYPE
    SYNTAX MacAddress
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Unique MAC Address assigned to the STA."
    ::= { dot11OperationEntry 1 }

dot11RTSThreshold OBJECT-TYPE
    SYNTAX INTEGER (0..2347)
    MAX-ACCESS read-write
    STATUS current

```

DESCRIPTION

"This attribute shall indicate the number of octets in an MPDU, below which an RTS/CTS handshake shall not be performed. An RTS/CTS handshake shall be performed at the beginning of any frame exchange sequence where the MPDU is of type Data or Management, the MPDU has an individual address in the Address1 field, and the length of the MPDU is greater than this threshold. (For additional details, refer to Table 21 in 9.7.) Setting this attribute to be larger than the maximum MSDU size shall have the effect of turning off the RTS/CTS handshake for frames of Data or Management type transmitted by this STA. Setting this attribute to zero shall have the effect of turning on the RTS/CTS handshake for all frames of Data or Management type transmitted by this STA. The default value of this attribute shall be 2347."

```
::= { dot11OperationEntry 2 }
```

dot11ShortRetryLimit OBJECT-TYPE

```
SYNTAX INTEGER (1..255)
MAX-ACCESS read-write
STATUS current
DESCRIPTION
```

"This attribute shall indicate the maximum number of transmission attempts of a frame, the length of which is less than or equal to dot11RTSThreshold, that shall be made before a failure condition is indicated. The default value of this attribute shall be 7."

```
::= { dot11OperationEntry 3 }
```

dot11LongRetryLimit OBJECT-TYPE

```
SYNTAX INTEGER (1..255)
MAX-ACCESS read-write
STATUS current
DESCRIPTION
```

"This attribute shall indicate the maximum number of transmission attempts of a frame, the length of which is greater than dot11RTSThreshold, that shall be made before a failure condition is indicated. The default value of this attribute shall be 4."

```
::= { dot11OperationEntry 4 }
```

dot11FragmentationThreshold OBJECT-TYPE

```
SYNTAX INTEGER (256..2346)
MAX-ACCESS read-write
STATUS current
DESCRIPTION
```

"This attribute shall specify the current maximum size, in octets, of the MPDU that may be delivered to the PHY. An MSDU shall be broken into fragments if its size exceeds the value of this attribute after adding MAC headers and trailers. An MSDU or MMPDU shall be fragmented when the resulting frame has an individual address in the Address1 field, and the length of the frame is larger than this threshold. The default value

for this attribute shall be the lesser of 2346 or the aMPDUMaxLength of the attached PHY and shall never exceed the lesser of 2346 or the aMPDUMaxLength of the attached PHY. The value of this attribute shall never be less than 256."

```
::= { dot11OperationEntry 5 }
```

```
dot11MaxTransmitMSDULifetime OBJECT-TYPE
    SYNTAX INTEGER (1..4294967295)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
```

"The MaxTransmitMSDULifetime shall be the elapsed time in TU, after the initial transmission of an MSDU, after which further attempts to transmit the MSDU shall be terminated. The default value of this attribute shall be 512."

```
::= { dot11OperationEntry 6 }
```

```
dot11MaxReceiveLifetime OBJECT-TYPE
    SYNTAX INTEGER (1..4294967295)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
```

"The MaxReceiveLifetime shall be the elapsed time in TU, after the initial reception of a fragmented MMPDU or MSDU, after which further attempts to reassemble the MMPDU or MSDU shall be terminated. The default value shall be 512."

```
::= { dot11OperationEntry 7 }
```

```
dot11ManufacturerID OBJECT-TYPE
    SYNTAX DisplayString (SIZE(0..128))
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
```

"The ManufacturerID shall include, at a minimum, the name of the manufacturer. It may include additional information at the manufacturer's discretion. The default value of this attribute shall be null."

```
::= { dot11OperationEntry 8 }
```

```
dot11ProductID OBJECT-TYPE
    SYNTAX DisplayString (SIZE(0..128))
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
```

"The ProductID shall include, at a minimum, an identifier that is unique to the manufacturer. It may include additional information at the manufacturer's discretion. The default value of this attribute shall be null."

```
::= { dot11OperationEntry 9 }
```

```
-- *****
-- *    End of dot11OperationEntry TABLE
```

```

-- *****
-- *****
-- *      dot11Counters TABLE
-- *****
dot11CountersTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11CountersEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION

        "Group containing attributes that are MAC counters.
        Implemented as a table to allow for multiple
        instantiations on an agent."

    ::= { dot11mac 2 }

dot11CountersEntry OBJECT-TYPE
    SYNTAX Dot11CountersEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION

        "An entry in the dot11CountersEntry Table.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry. Interface tables in this MIB module are indexed
        by ifIndex."
    INDEX {ifIndex}
    ::= { dot11CountersTable 1 }

Dot11CountersEntry ::= SEQUENCE {
    dot11TransmittedFragmentCount      Counter32,
    dot11MulticastTransmittedFrameCount Counter32,
    dot11FailedCount                   Counter32,
    dot11RetryCount                    Counter32,
    dot11MultipleRetryCount            Counter32,
    dot11FrameDuplicateCount           Counter32,
    dot11RTSSuccessCount               Counter32,
    dot11RTSFailureCount               Counter32,
    dot11ACKFailureCount               Counter32,
    dot11ReceivedFragmentCount         Counter32,
    dot11MulticastReceivedFrameCount   Counter32,
    dot11FCSErrorCount                 Counter32,
    dot11TransmittedFrameCount         Counter32,
    dot11WEPUndecryptableCount         Counter32 }

dot11TransmittedFragmentCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

        "This counter shall be incremented for an acknowledged
        MPDU with an individual address in the address 1 field
        or an MPDU with a multicast address in the address 1 field
        of type Data or Management."

    ::= { dot11CountersEntry 1 }

```

```

dot11MulticastTransmittedFrameCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

        "This counter shall increment only when the multicast
        bit is set in the destination MAC address of a successfully
        transmitted MSDU.  When operating as a STA in an ESS, where
        these frames are directed to the AP, this implies having
        received an acknowledgment to all associated MPDUs.  "

    ::= { dot11CountersEntry 2 }

dot11FailedCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

        "This counter shall increment when an MSDU is not
        transmitted successfully due to the number of
        transmit attempts exceeding either the
        dot11ShortRetryLimit or dot11LongRetryLimit.  "

    ::= { dot11CountersEntry 3 }

dot11RetryCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

        "This counter shall increment when an MSDU is successfully
        transmitted after one or more retransmissions."

    ::= { dot11CountersEntry 4 }

dot11MultipleRetryCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

        "This counter shall increment when an MSDU is successfully
        transmitted after more than one retransmission."

    ::= { dot11CountersEntry 5 }

dot11FrameDuplicateCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

        "This counter shall increment when a frame is received
        that the Sequence Control field indicates is a
        duplicate."

    ::= { dot11CountersEntry 6 }

```

```
dot11RTSSuccessCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

    "This counter shall increment when a CTS is received in
    response to an RTS."

    ::= { dot11CountersEntry 7 }

dot11RTSFailureCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

    "This counter shall increment when a CTS is not received in
    response to an RTS."

    ::= { dot11CountersEntry 8 }

dot11ACKFailureCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

    "This counter shall increment when an ACK is not received
    when expected."

    ::= { dot11CountersEntry 9 }

dot11ReceivedFragmentCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

    "This counter shall be incremented for each successfully
    received MPDU of type Data or Management."

    ::= { dot11CountersEntry 10 }

dot11MulticastReceivedFrameCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

    "This counter shall increment when a MSDU is received
    with the multicast bit set in the destination
    MAC address."

    ::= { dot11CountersEntry 11 }

dot11FCSErrorCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
```

```

STATUS current
DESCRIPTION

"This counter shall increment when an FCS error is
detected in a received MPDU."

 ::= { dot11CountersEntry 12 }

dot11TransmittedFrameCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

    "This counter shall increment for each successfully transmitted MSDU."

 ::= { dot11CountersEntry 13 }

dot11WEPUndecryptableCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

    "This counter shall increment when a frame is received with
    the WEP subfield of the Frame Control field set to one and the
    WEPon value for the key mapped to the TA's MAC address
    indicates that the frame should not have been encrypted or
    that frame is discarded due to the receiving STA not
    implementing the privacy option."

 ::= { dot11CountersEntry 14 }

-- *****
-- *      End of dot11CountersEntry  TABLE
-- *****

-- *****
-- *      GroupAddresses  TABLE
-- *****

dot11GroupAddressesTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11GroupAddressesEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION

    "A conceptual table containing a set of MAC addresses
    identifying the multicast addresses for which this STA
    will receive frames.  The default value of this attribute
    shall be null."

 ::= { dot11mac 3 }

dot11GroupAddressesEntry OBJECT-TYPE
    SYNTAX Dot11GroupAddressesEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION

    "An Entry (conceptual row) in the Group Addresses Table.

```

```

    ifIndex - Each 802.11 interface is represented by an
    ifEntry. Interface tables in this MIB module are indexed
    by ifIndex."
INDEX {ifIndex, dot11GroupAddressesIndex}

 ::= { dot11GroupAddressesTable 1 }

Dot11GroupAddressesEntry ::= SEQUENCE {
    dot11GroupAddressesIndex Integer32,
    dot11Address              MacAddress,
    dot11GroupAddressesStatus RowStatus}

dot11GroupAddressesIndex OBJECT-TYPE
    SYNTAX Integer32
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION

        "The auxiliary variable used to identify instances
        of the columnar objects in the Group Addresses Table."

 ::= { dot11GroupAddressesEntry 1 }

dot11Address OBJECT-TYPE
    SYNTAX MacAddress
    MAX-ACCESS read-create
    STATUS current
    DESCRIPTION

        "MAC address identifying a multicast addresses
        from which this STA will receive frames."
 ::= { dot11GroupAddressesEntry 2 }

dot11GroupAddressesStatus OBJECT-TYPE
    SYNTAX RowStatus
    MAX-ACCESS read-create
    STATUS current
    DESCRIPTION

        "The status column used for creating, modifying, and
        deleting instances of the columnar objects in the Group
        Addresses Table."

    DEFVAL {active}
 ::= { dot11GroupAddressesEntry 3 }
-- *****
-- *      End of GroupAddress TABLE
-- *****

-- *****
-- *      Resource Type Attribute Templates
-- *****

dot11ResourceTypeIDName OBJECT-TYPE
    SYNTAX DisplayString (SIZE(4))
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

```

"Contains the name of the Resource Type ID managed object. The attribute is read-only and always contains the value RTID. This attribute value shall not be used as a naming attribute for any other managed object class."

```
REFERENCE "IEEE Std 802.1F-1993, A.7"
DEFVAL {"RTID"}
 ::= { dot11resAttribute 1 }
```

```
-- *****
-- * dot11ResourceInfo TABLE
-- *****
```

```
dot11ResourceInfoTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11ResourceInfoEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
```

"Provides a means of indicating, in data readable from a managed object, information that identifies the source of the implementation."

```
REFERENCE "IEEE Std 802.1F-1993, A.7"
 ::= { dot11resAttribute 2 }
```

```
dot11ResourceInfoEntry OBJECT-TYPE
    SYNTAX Dot11ResourceInfoEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
```

"An entry in the dot11ResourceInfo Table.

ifIndex - Each 802.11 interface is represented by an ifEntry. Interface tables in this MIB module are indexed by ifIndex."

```
INDEX {ifIndex}
```

```
 ::= { dot11ResourceInfoTable 1 }
```

```
Dot11ResourceInfoEntry ::= SEQUENCE {
    dot11manufacturerOUI          OCTET STRING,
    dot11manufacturerName        DisplayString,
    dot11manufacturerProductName  DisplayString,
    dot11manufacturerProductVersion DisplayString}
```

```
dot11manufacturerOUI OBJECT-TYPE
    SYNTAX OCTET STRING (SIZE(3))
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
```

"Takes the value of an organizationally unique identifier."

```
 ::= { dot11ResourceInfoEntry 1 }
```

```
dot11manufacturerName OBJECT-TYPE
    SYNTAX DisplayString (SIZE(0..128))
    MAX-ACCESS read-only
```

```

STATUS current
DESCRIPTION

"A printable string used to identify the manufacturer of the
resource. Maximum string length is 128 octets."
 ::= { dot11ResourceInfoEntry 2 }

dot11manufacturerProductName OBJECT-TYPE
SYNTAX DisplayString (SIZE(0..128))
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"A printable string used to identify the manufacturer's product
name of the resource. Maximum string length is 128 octets."
 ::= { dot11ResourceInfoEntry 3 }

dot11manufacturerProductVersion OBJECT-TYPE
SYNTAX DisplayString (SIZE(0..128))
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"Printable string used to identify the manufacturer's product
version of the resource. Maximum string length is 128 octets."
 ::= { dot11ResourceInfoEntry 4 }

-- *****
-- * End of dot11ResourceInfo TABLE
-- *****

-- *****
-- * PHY Attribute Templates
-- *****

-- *****
-- * dot11PhyOperation TABLE
-- *****
dot11PhyOperationTable OBJECT-TYPE
SYNTAX SEQUENCE OF Dot11PhyOperationEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

"PHY level attributes concerned with
operation. Implemented as a table indexed on
ifIndex to allow for multiple instantiations on an
Agent."

 ::= { dot11phy 1 }

dot11PhyOperationEntry OBJECT-TYPE
SYNTAX Dot11PhyOperationEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

"An entry in the dot11PhyOperation Table.

```



```

        ifIndex - Each 802.11 interface is represented by an
        ifEntry. Interface tables in this MIB module are indexed
        by ifIndex."
    INDEX {ifIndex}
 ::= { dot11PhyOperationTable 1 }

Dot11PhyOperationEntry ::= SEQUENCE {
    dot11PHYType          INTEGER,
    dot11CurrentRegDomain Integer32,
    dot11TempType         INTEGER
}

dot11PHYType OBJECT-TYPE
    SYNTAX INTEGER {fhss(1), dsss(2), irbaseband(3)}
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

        "This is an 8-bit integer value that identifies the PHY type
        supported by the attached PLCP and PMD. Currently defined
        values and their corresponding PHY types are:

        FHSS 2.4 GHz = 01 , DSSS 2.4 GHz = 02, IR Baseband = 03"

 ::= { dot11PhyOperationEntry 1 }

dot11CurrentRegDomain OBJECT-TYPE
    SYNTAX Integer32
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION

        "The current regulatory domain this instance of the PMD is
        supporting. This object corresponds to one of the
        RegDomains listed in dot11RegDomainsSupported."

 ::= { dot11PhyOperationEntry 2 }

dot11TempType OBJECT-TYPE
    SYNTAX INTEGER {tempType1(1), tempType2(2) }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

        "There are different operating temperature requirements
        dependent on the anticipated environmental conditions. This
        attribute describes the current PHY's operating temperature
        range capability. Currently defined values and their
        corresponding temperature ranges are:

        Type 1 = X'01'-Commercial range of 0 to 40 degrees C,
        Type 2 = X'02'-Industrial range of -30 to 70 degrees C."

 ::= { dot11PhyOperationEntry 3 }

-- *****
-- *      End of dot11PhyOperation TABLE
-- *****

```

```

-- *****
-- *   dot11PhyAntenna  TABLE
-- *****
dot11PhyAntennaTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11PhyAntennaEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION

        "Group of attributes for PhyAntenna.  Implemented as a
        table indexed on ifIndex to allow for multiple instances on
        an agent."

    ::= { dot11phy 2 }

dot11PhyAntennaEntry OBJECT-TYPE
    SYNTAX Dot11PhyAntennaEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION

        "An entry in the dot11PhyAntenna Table.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry.  Interface tables in this MIB module are indexed
        by ifIndex."
    INDEX {ifIndex}
    ::= { dot11PhyAntennaTable 1 }

Dot11PhyAntennaEntry ::= SEQUENCE {
    dot11CurrentTxAntenna      Integer32,
    dot11DiversitySupport     INTEGER,
    dot11CurrentRxAntenna     Integer32 }

dot11CurrentTxAntenna OBJECT-TYPE
    SYNTAX Integer32 (1..255)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION

        "The current antenna being used to transmit.  This value
        is one of the values appearing in dot11SupportedTxAntenna.
        This may be used by a management agent to control which
        antenna is used for transmission."

    ::= { dot11PhyAntennaEntry 1 }

dot11DiversitySupport OBJECT-TYPE
    SYNTAX INTEGER {fixedlist(1), notsupported(2), dynamic(3)}
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

        "This implementation's support for diversity, encoded as:

        X'01'-diversity is available and is performed over the fixed
        list of antennas defined in dot11DiversitySelectionRx.

        X'02'-diversity is not supported."

```

```

X'03'-diversity is supported and control of diversity is also
available, in which case the attribute
dot11DiversitySelectionRx can be dynamically modified by the
LME."
 ::= { dot11PhyAntennaEntry 2 }

dot11CurrentRxAntenna OBJECT-TYPE
    SYNTAX Integer32 (1..255)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION

        "The current antenna being used to receive, if the
        dot11 DiversitySupport indicates that diversity is not
        supported. The selected antenna shall be one of
        the antennae marked for receive in the dot11AntennasListTable. "

    ::= { dot11PhyAntennaEntry 3 }

-- *****
-- *      End of dot11PhyAntenna  TABLE
-- *****

-- *****
-- *      dot11PhyTxPower  TABLE
-- *****
dot11PhyTxPowerTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11PhyTxPowerEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION

        "Group of attributes for dot11PhyTxPowerTable. Implemented
        as a table indexed on STA ID to allow for multiple
        instances on an Agent."

    ::= { dot11phy 3}

dot11PhyTxPowerEntry OBJECT-TYPE
    SYNTAX Dot11PhyTxPowerEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION

        "An entry in the dot11PhyTxPower Table.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry. Interface tables in this MIB module are indexed
        by ifIndex."
    INDEX {ifIndex}
    ::= { dot11PhyTxPowerTable 1 }

Dot11PhyTxPowerEntry ::= SEQUENCE {
    dot11NumberSupportedPowerLevels  INTEGER,
    dot11TxPowerLevel1                INTEGER,
    dot11TxPowerLevel2                INTEGER,
    dot11TxPowerLevel3                INTEGER,
    dot11TxPowerLevel4                INTEGER,
    dot11TxPowerLevel5                INTEGER,

```

```

dot11TxPowerLevel6                INTEGER,
dot11TxPowerLevel7                INTEGER,
dot11TxPowerLevel8                INTEGER,
dot11CurrentTxPowerLevel          INTEGER}

dot11NumberSupportedPowerLevels OBJECT-TYPE
    SYNTAX INTEGER (1..8)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The number of power levels supported by the PMD.
        This attribute can have a value of 1 to 8."
 ::= { dot11PhyTxPowerEntry 1 }

dot11TxPowerLevel1 OBJECT-TYPE
    SYNTAX INTEGER (0..10000)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The transmit output power for LEVEL1 in mW.
        This is also the default power level."
 ::= { dot11PhyTxPowerEntry 2 }

dot11TxPowerLevel2 OBJECT-TYPE
    SYNTAX INTEGER (0..10000)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The transmit output power for LEVEL2 in mW."
 ::= { dot11PhyTxPowerEntry 3 }

dot11TxPowerLevel3 OBJECT-TYPE
    SYNTAX INTEGER (0..10000)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The transmit output power for LEVEL3 in mW."
 ::= { dot11PhyTxPowerEntry 4 }

dot11TxPowerLevel4 OBJECT-TYPE
    SYNTAX INTEGER (0..10000)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The transmit output power for LEVEL4 in mW."
 ::= { dot11PhyTxPowerEntry 5 }

dot11TxPowerLevel5 OBJECT-TYPE
    SYNTAX INTEGER (0..10000)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The transmit output power for LEVEL5 in mW."
 ::= { dot11PhyTxPowerEntry 6 }

dot11TxPowerLevel6 OBJECT-TYPE
    SYNTAX INTEGER (0..10000)
    MAX-ACCESS read-only
    STATUS current

```

```

DESCRIPTION
    "The transmit output power for LEVEL6 in mW."
 ::= { dot11PhyTxPowerEntry 7 }

dot11TxPowerLevel7 OBJECT-TYPE
    SYNTAX INTEGER (0..10000)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The transmit output power for LEVEL7 in mW."
 ::= { dot11PhyTxPowerEntry 8 }

dot11TxPowerLevel8 OBJECT-TYPE
    SYNTAX INTEGER (0..10000)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The transmit output power for LEVEL8 in mW."
 ::= { dot11PhyTxPowerEntry 9 }

dot11CurrentTxPowerLevel OBJECT-TYPE
    SYNTAX INTEGER (1..8)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The TxPowerLevel N currently being used to transmit data.
        Some PHYs also use this value to determine the receiver
        sensitivity requirements for CCA."

 ::= { dot11PhyTxPowerEntry 10 }

-- *****
-- *      End of dot11PhyTxPower  TABLE
-- *****

-- *****
-- *      dot11PhyFHSS  TABLE
-- *****
dot11PhyFHSSTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11PhyFHSSEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Group of attributes for dot11PhyFHSSTable.  Implemented as a
        table indexed on STA ID to allow for multiple instances on
        an Agent."

 ::= { dot11phy 4 }

dot11PhyFHSSEntry OBJECT-TYPE
    SYNTAX Dot11PhyFHSSEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "An entry in the dot11PhyFHSS Table.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry.  Interface tables in this MIB module are indexed
        by ifIndex."

```

```

INDEX {ifIndex}
 ::= { dot11PhyFHSSTable 1 }

Dot11PhyFHSSEntry ::= SEQUENCE {
    dot11HopTime                INTEGER,
    dot11CurrentChannelNumber   INTEGER,
    dot11MaxDwellTime           INTEGER,
    dot11CurrentDwellTime       INTEGER,
    dot11CurrentSet              INTEGER,
    dot11CurrentPattern          INTEGER,
    dot11CurrentIndex            INTEGER}

dot11HopTime OBJECT-TYPE
    SYNTAX INTEGER (224)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The time in microseconds for the PMD to change from
        channel 2 to channel 80"
 ::= { dot11PhyFHSSEntry 1 }

dot11CurrentChannelNumber OBJECT-TYPE
    SYNTAX INTEGER (0..99)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The current channel number of the frequency output by the RF
        synthesizer"
 ::= { dot11PhyFHSSEntry 2 }

dot11MaxDwellTime OBJECT-TYPE
    SYNTAX INTEGER (1..65535)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The maximum time in TU that the transmitter
        is permitted to operate on a single channel."
 ::= { dot11PhyFHSSEntry 3 }

dot11CurrentDwellTime OBJECT-TYPE
    SYNTAX INTEGER (1..65535)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The current time in TU that the transmitter shall operate
        on a single channel, as set by the MAC. Default is 19 TU."
 ::= { dot11PhyFHSSEntry 4 }

dot11CurrentSet OBJECT-TYPE
    SYNTAX INTEGER (1..255)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The current set of patterns the PHY
        LME is using to determine the hopping sequence. "
 ::= { dot11PhyFHSSEntry 5 }

dot11CurrentPattern OBJECT-TYPE
    SYNTAX INTEGER (0..255)

```

```

MAX-ACCESS read-write
STATUS current
DESCRIPTION
    "The current pattern the PHY LME is
    using to determine the hop sequence."
 ::= { dot11PhyFHSSEntry 6 }

dot11CurrentIndex OBJECT-TYPE
    SYNTAX INTEGER (1..255)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The current index value the PHY LME is using to determine
        the CurrentChannelNumber."

 ::= { dot11PhyFHSSEntry 7 }

-- *****
-- *      End of dot11PhyFHSS  TABLE
-- *****

-- *****
-- *      dot11PhyDSSSEntry  TABLE
-- *****
dot11PhyDSSSTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11PhyDSSSEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Entry of attributes for dot11PhyDSSSEntry.  Implemented as a
        table indexed on ifIndex allow for multiple instances on
        an Agent."

 ::= { dot11phy 5 }

dot11PhyDSSSEntry OBJECT-TYPE
    SYNTAX Dot11PhyDSSSEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "An entry in the dot11PhyDSSSEntry Table.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry.  Interface tables in this MIB module are indexed
        by ifIndex."
    INDEX {ifIndex}
 ::= { dot11PhyDSSSTable 1 }

Dot11PhyDSSSEntry ::= SEQUENCE {
    dot11CurrentChannel    INTEGER,
    dot11CCAModeSupported  INTEGER,
    dot11CurrentCCAMode    INTEGER,
    dot11EDThreshold       Integer32}

dot11CurrentChannel OBJECT-TYPE
    SYNTAX INTEGER (1..14)
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION

```

```

        "The current operating frequency channel of the DSSS
        PHY. Valid channel numbers are as defined in 15.4.6.2"
 ::= { dot11PhyDSSSEntry 1 }

dot11CCAModeSupported OBJECT-TYPE
    SYNTAX INTEGER (1..7)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "dot11CCAModeSupported is a bit-significant value, representing all of the
        CCA modes supported by the PHY. Valid values are:

            energy detect only (ED_ONLY) = 01,
            carrier sense only (CS_ONLY) = 02,
            carrier sense and energy detect (ED_and_CS)= 04

or the logical sum of any of these values."
 ::= { dot11PhyDSSSEntry 2 }

dot11CurrentCCAMode OBJECT-TYPE
    SYNTAX INTEGER {edonly(1), csonly(2), edandcs(4)}
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The current CCA method in operation. Valid values are:
            energy detect only (edonly) = 01,
            carrier sense only (csonly) = 02,
            carrier sense and energy detect (edandcs)= 04."
 ::= { dot11PhyDSSSEntry 3 }

dot11EDThreshold OBJECT-TYPE
    SYNTAX Integer32
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The current Energy Detect Threshold being used by the DSSS PHY."
 ::= { dot11PhyDSSSEntry 4 }

-- *****
-- * End of dot11PhyDSSSEntry TABLE
-- *****

-- *****
-- * dot11PhyIR TABLE
-- *****

dot11PhyIRTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11PhyIREntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Group of attributes for dot11PhyIRTable. Implemented as a
        table indexed on ifIndex to allow for multiple instances on
        an Agent."

 ::= { dot11phy 6 }

dot11PhyIREntry OBJECT-TYPE
    SYNTAX Dot11PhyIREntry
    MAX-ACCESS not-accessible

```



```

STATUS current
DESCRIPTION
    "An entry in the dot11PhyIR Table.

    ifIndex - Each 802.11 interface is represented by an
    ifEntry. Interface tables in this MIB module are indexed
    by ifIndex."
INDEX {ifIndex}
 ::= { dot11PhyIRTable 1 }

Dot11PhyIREntry ::= SEQUENCE {
    dot11CCAWatchdogTimerMax      Integer32,
    dot11CCAWatchdogCountMax     Integer32,
    dot11CCAWatchdogTimerMin     Integer32,
    dot11CCAWatchdogCountMin     Integer32}

dot11CCAWatchdogTimerMax OBJECT-TYPE
    SYNTAX Integer32
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "This parameter, together with CCAWatchdogCountMax,
        determines when energy detected in the channel can be
        ignored."

 ::= { dot11PhyIREntry 1 }

dot11CCAWatchdogCountMax OBJECT-TYPE
    SYNTAX Integer32
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "This parameter, together with CCAWatchdogTimerMax,
        determines when energy detected in the channel can be
        ignored."

 ::= { dot11PhyIREntry 2 }

dot11CCAWatchdogTimerMin OBJECT-TYPE
    SYNTAX Integer32
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The minimum value to which CCAWatchdogTimerMax can be
        set."

 ::= { dot11PhyIREntry 3 }

dot11CCAWatchdogCountMin OBJECT-TYPE
    SYNTAX Integer32
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The minimum value to which CCAWatchdogCount can be set."

 ::= { dot11PhyIREntry 4 }

-- *****
-- *      End of dot11PhyIR TABLE
-- *****

```

```

-- *****
-- *   dot11RegDomainsSupported  TABLE
-- *****
dot11RegDomainsSupportedTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11RegDomainsSupportEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "There are different operational requirements dependent on
        the regulatory domain.  This attribute list describes the
        regulatory domains the PLCP and PMD support in this
        implementation.  Currently defined values and their
        corresponding Regulatory Domains are:

        FCC (USA) = X'10', DOC (Canada) = X'20', ETSI (most of
        Europe) = X'30', Spain = X'31', France = X'32', MKK
        (Japan) = X'40' "

    ::= { dot11phy 7}

dot11RegDomainsSupportEntry OBJECT-TYPE
    SYNTAX Dot11RegDomainsSupportEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "An entry in the dot11RegDomainsSupport Table.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry.  Interface tables in this MIB module are indexed
        by ifIndex."
    INDEX {ifIndex, dot11RegDomainsSupportIndex}
    ::= { dot11RegDomainsSupportedTable 1 }

Dot11RegDomainsSupportEntry ::= SEQUENCE {
    dot11RegDomainsSupportIndex    Integer32,
    dot11RegDomainsSupportValue    INTEGER}

dot11RegDomainsSupportIndex OBJECT-TYPE
    SYNTAX Integer32
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The auxiliary variable used to identify instances
        of the columnar objects in the RegDomainsSupport Table."
    ::= { dot11RegDomainsSupportEntry 1 }

dot11RegDomainsSupportValue OBJECT-TYPE
    SYNTAX INTEGER {fcc(16), doc(32), etsi(48), spain (49), france
    (50), mkk (64) }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "There are different operational requirements dependent on
        the regulatory domain.  This attribute list describes the
        regulatory domains the PLCP and PMD support in this
        implementation.  Currently defined values and their
        corresponding Regulatory Domains are:

```

```

        FCC (USA) = X'10', DOC (Canada) = X'20', ETSI (most of
        Europe) = X'30', Spain = X'31', France = X'32', MKK
        (Japan) = X'40' "
 ::= { dot11RegDomainsSupportEntry 2 }

-- *****
-- * End of dot11RegDomainsSupported TABLE
-- *****

-- *****
-- * dot11AntennasList TABLE
-- *****
dot11AntennasListTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11AntennasListEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "This table represents the list of antennae. An
        antenna can be marked to be capable of transmitting,
        receiving, and/or for participation in receive diversity. Each
        entry in this table represents a single antenna with
        its properties. The maximum number of antennae that can
        be contained in this table is 255."
 ::= { dot11phy 8 }

dot11AntennasListEntry OBJECT-TYPE
    SYNTAX Dot11AntennasListEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "An entry in the dot11AntennasListTable,
        representing the properties of a single antenna.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry. Interface tables in this MIB module are indexed
        by ifIndex."
    INDEX {ifIndex, dot11AntennaListIndex}
 ::= { dot11AntennasListTable 1 }

Dot11AntennasListEntry ::= SEQUENCE {
    dot11AntennaListIndex Integer32,
    dot11SupportedTxAntenna TruthValue,
    dot11SupportedRxAntenna TruthValue,
    dot11DiversitySelectionRx TruthValue }

dot11AntennaListIndex OBJECT-TYPE
    SYNTAX Integer32 (1..255)
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The unique index of an antenna which is
        used to identify the columnar objects in
        the dot11AntennasList Table."
 ::= { dot11AntennasListEntry 1 }

dot11SupportedTxAntenna OBJECT-TYPE
    SYNTAX TruthValue
    MAX-ACCESS read-write
    STATUS current

```

```

DESCRIPTION
    "When true, this object indicates that the
    antenna represented by dot11AntennaIndex
    can be used as a transmit antenna."

 ::= { dot11AntennasListEntry 2 }

dot11SupportedRxAntenna OBJECT-TYPE
    SYNTAX TruthValue
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "When true, this object indicates that the
        antenna represented by the dot11AntennaIndex
        can be used as a receive antenna."

 ::= { dot11AntennasListEntry 3 }

dot11DiversitySelectionRx OBJECT-TYPE
    SYNTAX TruthValue
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "When true, this object indicates that the
        antenna represented by dot11AntennaIndex can
        be used for receive diversity. This object
        may only be true if the antenna can be used
        as a receive antenna, as indicated by
        dot11SupportedRxAntenna."

 ::= { dot11AntennasListEntry 4 }

-- *****
-- *      End of dot11AntennasList  TABLE
-- *****

-- *****
-- *      SupportedDataRatesTx  TABLE
-- *****

dot11SupportedDataRatesTxTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dot11SupportedDataRatesTxEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION

        "The Transmit bit rates supported by the PLCP and PMD,
        represented by a count from X'02-X'7f, corresponding to data
        rates in increments of 500Kb/s from 1 Mbit/s to 63.5 Mbit/s subject
        to limitations of each individual PHY."

 ::= { dot11phy 9 }

dot11SupportedDataRatesTxEntry OBJECT-TYPE
    SYNTAX Dot11SupportedDataRatesTxEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION

        "An Entry (conceptual row) in the dot11SupportedDataRatesTx

```

Table.

ifIndex - Each 802.11 interface is represented by an ifEntry. Interface tables in this MIB module are indexed by ifIndex."

INDEX {ifIndex, dot11SupportedDataRatesTxIndex}

::= { dot11SupportedDataRatesTxTable 1 }

Dot11SupportedDataRatesTxEntry ::= SEQUENCE {
 dot11SupportedDataRatesTxIndex Integer32,
 dot11SupportedDataRatesTxValue Integer32}

dot11SupportedDataRatesTxIndex OBJECT-TYPE

SYNTAX Integer32 (1..8)
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION

"Index object which identifies which data rate to access.
 Range is 1..8."

::= { dot11SupportedDataRatesTxEntry 1 }

dot11SupportedDataRatesTxValue OBJECT-TYPE

SYNTAX Integer32 (2..127)
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION

"The Transmit bit rates supported by the PLCP and PMD, represented by a count from X'02-X'7f, corresponding to data rates in increments of 500Kb/s from 1 Mbit/s to 63.5 Mbit/s subject to limitations of each individual PHY."

::= { dot11SupportedDataRatesTxEntry 2 }

-- *****
 -- * End of dot11SupportedDataRatesTx TABLE
 -- *****

-- *****
 -- * SupportedDataRatesRx TABLE
 -- *****

dot11SupportedDataRatesRxTable OBJECT-TYPE

SYNTAX SEQUENCE OF Dot11SupportedDataRatesRxEntry
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION

"The receive bit rates supported by the PLCP and PMD, represented by a count from X'002-X'7f, corresponding to data rates in increments of 500Kb/s from 1 Mbit/s to 63.5 Mbit/s."

::= { dot11phy 10 }

dot11SupportedDataRatesRxEntry OBJECT-TYPE

SYNTAX Dot11SupportedDataRatesRxEntry
 MAX-ACCESS not-accessible

```

STATUS current
DESCRIPTION

    "An Entry (conceptual row) in the
    dot11SupportedDataRatesRx Table.

        ifIndex - Each 802.11 interface is represented by an
        ifEntry. Interface tables in this MIB module are indexed
        by ifIndex."

INDEX {ifIndex, dot11SupportedDataRatesRxIndex}

 ::= { dot11SupportedDataRatesRxTable 1 }

Dot11SupportedDataRatesRxEntry ::= SEQUENCE {
    dot11SupportedDataRatesRxIndex Integer32,
    dot11SupportedDataRatesRxValue Integer32}

dot11SupportedDataRatesRxIndex OBJECT-TYPE
    SYNTAX Integer32 (1..8)
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Index object which identifies which data rate to access.
        Range is 1..8."
 ::= { dot11SupportedDataRatesRxEntry 1 }

dot11SupportedDataRatesRxValue OBJECT-TYPE
    SYNTAX Integer32 (2..127)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The receive bit rates supported by the PLCP and PMD,
        represented by a count from X'02-X'7f, corresponding to data
        rates in increments of 500 Kb/s from 1 Mbit/s to 63.5 Mbit/s."
 ::= { dot11SupportedDataRatesRxEntry 2 }

-- *****
-- * End of dot11SupportedDataRatesRx TABLE
-- *****

-- *****
-- * conformance information
-- *****

dot11Conformance OBJECT IDENTIFIER ::= { ieee802dot11 5 }
dot11Groups OBJECT IDENTIFIER ::= { dot11Conformance 1 }
dot11Compliances OBJECT IDENTIFIER ::= { dot11Conformance 2 }

-- *****
-- * compliance statements
-- *****

dot11Compliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The compliance statement for SNMPv2 entities
        that implement the IEEE 802.11 MIB."

MODULE -- this module
    MANDATORY-GROUPS {

```

```

dot11SMTbase2,
dot11MACbase, dot11CountersGroup,
dot11SmtAuthenticationAlgorithms,
dot11ResourceTypeID, dot11PhyOperationComplianceGroup }

GROUP dot11PhyDSSSComplianceGroup
DESCRIPTION
    "Implementation of this group is required when object
dot11PHYType has the value of dsss. This group is
mutually exclusive with the groups dot11PhyIRComplianceGroup and
dot11PhyFHSSComplianceGroup."

GROUP dot11PhyIRComplianceGroup
DESCRIPTION
    "Implementation of this group is required when object
dot11PHYType has the value of irbaseband. This group is
mutually exclusive with the groups dot11PhyDSSSComplianceGroup and
dot11PhyFHSSComplianceGroup."

GROUP dot11PhyFHSSComplianceGroup
DESCRIPTION
    "Implementation of this group is required when object
dot11PHYType has the value of fhss. This group is
mutually exclusive with the groups dot11PhyDSSSComplianceGroup and
dot11PhyIRComplianceGroup."

-- OPTIONAL-GROUPS { dot11SMTprivacy, dot11MACStatistics,
-- dot11PhyAntennaComplianceGroup, dot11PhyTxPowerComplianceGroup,
-- dot11PhyRegDomainsSupportGroup,
-- dot11PhyAntennasListGroup, dot11PhyRateGroup }
--

 ::= { dot11Compliances 1 }

-- *****
-- * Groups - units of conformance
-- *****
dot11SMTbase OBJECT-GROUP
    OBJECTS { dot11StationID, dot11MediumOccupancyLimit,
dot11CFPollable,
dot11CFPPeriod,
dot11CFPMaxDuration,
dot11AuthenticationResponseTimeOut,
dot11PrivacyOptionImplemented,
dot11PowerManagementMode,
dot11DesiredSSID, dot11DesiredBSSType,
dot11OperationalRateSet,
dot11BeaconPeriod, dot11DTIMPeriod,
dot11AssociationResponseTimeOut
    }
STATUS deprecated
DESCRIPTION
    "The SMT object class provides the necessary support at the
STA to manage the processes in the STA such that the STA may
work cooperatively as a part of an IEEE 802.11 network."
 ::= {dot11Groups 1 }

```

```

dot11SMTprivacy OBJECT-GROUP
  OBJECTS { dot11PrivacyInvoked,
            dot11WEPKeyMappingLength, dot11ExcludeUnencrypted,
            dot11WEPICVErrorCount , dot11WEPExcludedCount ,
            dot11WEPDefaultKeyID,
            dot11WEPDefaultKeyValue,
            dot11WEPKeyMappingWEPOn,
            dot11WEPKeyMappingValue , dot11WEPKeyMappingAddress,
            dot11WEPKeyMappingStatus }

  STATUS current
  DESCRIPTION
    "The SMTPrivacy package is a set of attributes that shall be
    present if WEP is implemented in the STA."
  ::= {dot11Groups 2 }

dot11MACbase OBJECT-GROUP

  OBJECTS { dot11MACAddress, dot11Address,
            dot11GroupAddressesStatus,
            dot11RTSThreshold, dot11ShortRetryLimit,
            dot11LongRetryLimit, dot11FragmentationThreshold,
            dot11MaxTransmitMSDULifetime,
            dot11MaxReceiveLifetime, dot11ManufacturerID,
            dot11ProductID

            }

  STATUS current
  DESCRIPTION
    "The MAC object class provides the necessary support for the
    access control, generation, and verification of frame check
    sequences, and proper delivery of valid data to upper
    layers."
  ::= {dot11Groups 3 }

dot11MACStatistics OBJECT-GROUP

  OBJECTS { dot11RetryCount, dot11MultipleRetryCount,
            dot11RTSSuccessCount, dot11RTSFailureCount,
            dot11ACKFailureCount, dot11FrameDuplicateCount }

  STATUS current
  DESCRIPTION
    "The MACStatistics package provides extended statistical
    information on the operation of the MAC. This
    package is completely optional."
  ::= {dot11Groups 4 }

dot11ResourceTypeID OBJECT-GROUP
  OBJECTS { dot11ResourceTypeIDName, dot11manufacturerOUI,
            dot11manufacturerName, dot11manufacturerProductName,
            dot11manufacturerProductVersion }
  STATUS current
  DESCRIPTION
    "Attributes used to identify a STA, its manufacturer,
    and various product names and versions."
  ::= {dot11Groups 5 }

```



```

dot11SmtAuthenticationAlgorithms OBJECT-GROUP
    OBJECTS { dot11AuthenticationAlgorithm,
              dot11AuthenticationAlgorithmsEnable }
    STATUS current
    DESCRIPTION
        "Authentication Algorithm Table."
    ::= { dot11Groups 6 }

dot11PhyOperationComplianceGroup OBJECT-GROUP
    OBJECTS { dot11PHYType, dot11CurrentRegDomain, dot11TempType }
    STATUS current
    DESCRIPTION
        "PHY layer operations attributes."
    ::= { dot11Groups 7 }

dot11PhyAntennaComplianceGroup OBJECT-GROUP
    OBJECTS { dot11CurrentTxAntenna, dot11DiversitySupport,
              dot11CurrentRxAntenna }
    STATUS current
    DESCRIPTION
        "Attributes for Data Rates for IEEE 802.11."
    ::= { dot11Groups 8 }

dot11PhyTxPowerComplianceGroup OBJECT-GROUP
    OBJECTS { dot11NumberSupportedPowerLevels, dot11TxPowerLevel1,
              dot11TxPowerLevel2, dot11TxPowerLevel3, dot11TxPowerLevel4,
              dot11TxPowerLevel5, dot11TxPowerLevel6, dot11TxPowerLevel7,
              dot11TxPowerLevel8, dot11CurrentTxPowerLevel }
    STATUS current
    DESCRIPTION
        "Attributes for Control and Management of transmit power."
    ::= { dot11Groups 9 }

dot11PhyFHSSComplianceGroup OBJECT-GROUP

    OBJECTS { dot11HopTime, dot11CurrentChannelNumber, dot11MaxDwellTime,
              dot11CurrentDwellTime, dot11CurrentSet, dot11CurrentPattern,
              dot11CurrentIndex }
    STATUS current
    DESCRIPTION
        "Attributes that configure the Frequency Hopping for IEEE
        802.11."
    ::= { dot11Groups 10 }

dot11PhyDSSSComplianceGroup OBJECT-GROUP

    OBJECTS { dot11CurrentChannel, dot11CCAModeSupported,
              dot11CurrentCCAMode, dot11EDThreshold }
    STATUS current
    DESCRIPTION
        "Attributes that configure the DSSS for IEEE 802.11."
    ::= { dot11Groups 11 }

dot11PhyIRComplianceGroup OBJECT-GROUP
    OBJECTS { dot11CCAWatchdogTimerMax, dot11CCAWatchdogCountMax,
              dot11CCAWatchdogTimerMin, dot11CCAWatchdogCountMin }

```

```

    STATUS current
    DESCRIPTION
        "Attributes that configure the baseband IR for IEEE 802.11."
    ::= { dot11Groups 12 }

dot11PhyRegDomainsSupportGroup OBJECT-GROUP
    OBJECTS { dot11RegDomainsSupportValue}
    STATUS current
    DESCRIPTION
        "Attributes that specify the supported Regulation Domains."
    ::= { dot11Groups 13}

dot11PhyAntennasListGroup OBJECT-GROUP
    OBJECTS { dot11SupportedTxAntenna,
              dot11SupportedRxAntenna, dot11DiversitySelectionRx }
    STATUS current
    DESCRIPTION
        "Attributes that specify the supported Regulation Domains."
    ::= { dot11Groups 14 }

dot11PhyRateGroup OBJECT-GROUP
    OBJECTS {dot11SupportedDataRatesTxValue,
            dot11SupportedDataRatesRxValue
    }
    STATUS current
    DESCRIPTION
        "Attributes for Data Rates for IEEE 802.11."
    ::= { dot11Groups 15 }

dot11CountersGroup OBJECT-GROUP
    OBJECTS {
        dot11TransmittedFragmentCount ,
        dot11MulticastTransmittedFrameCount ,
        dot11FailedCount, dot11ReceivedFragmentCount,
        dot11MulticastReceivedFrameCount ,
        dot11FCSErrorCount,
        dot11WEPUndecryptableCount,
        dot11TransmittedFrameCount }

    STATUS current
    DESCRIPTION
        "Attributes from the dot11CountersGroup that are not described
        in the dot11MACStatistics group. These objects are
        mandatory."
    ::= {dot11Groups 16 }

dot11NotificationGroup NOTIFICATION-GROUP
    NOTIFICATIONS { dot11Disassociate,
                  dot11Deauthenticate,
                  dot11AuthenticateFail }
    STATUS current
    DESCRIPTION
        "IEEE 802.11 notifications"
    ::= { dot11Groups 17 }

dot11SMTbase2 OBJECT-GROUP

```

```

OBJECTS { dot11MediumOccupancyLimit,
          dot11CFPollable,
          dot11CFPPeriod,
          dot11CFPMaxDuration,
          dot11AuthenticationResponseTimeOut,
          dot11PrivacyOptionImplemented,
          dot11PowerManagementMode,
          dot11DesiredSSID, dot11DesiredBSSType,
          dot11OperationalRateSet,
          dot11BeaconPeriod, dot11DTIMPeriod,
          dot11AssociationResponseTimeOut,
          dot11DisassociateReason,
          dot11DisassociateStation,
          dot11DeauthenticateReason,
          dot11DeauthenticateStation,
          dot11AuthenticateFailStatus,
          dot11AuthenticateFailStation
        }
STATUS current
DESCRIPTION
    "The SMTbase2 object class provides the necessary support at the
    STA to manage the processes in the STA such that the STA may
    work cooperatively as a part of an IEEE 802.11 network."
 ::= {dot11Groups 18 }

-- *****
-- *   End of 80211 MIB
-- *****
END

```

Annex E

(informative)

Bibliography

E.1 General

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E.2 Specification and description language (SDL) documentation

[B5] Belina, Ferenc, Dieter Hogrefe, and Amardeo Sarma, *SDL with Applications from Protocol Specification*. UK: Prentice Hall Europe, Hertfordshire, 1991.⁸

[B6] Ellsberger, Jan, Dieter Hogrefe, and Amardeo Sarma, *SDL, Formal Object-Oriented Language for Communicating Systems*. Hertfordshire, UK: Prentice Hall Europe, 1997.⁹

[B7] Faergemand, Ove and Anders Olsen, "New Features in SDL-92," *SDL Newsletter* (ISSN 1023-7151), no. 16 (May 1993), pp. 10–29. Also available online at <http://www.tdr.dk/public/SDL/SDL.html>.¹⁰

[B8] Olsen, Anders, Ove Faergemand, Birger Moller-Pedersen, Rick Reed, and T. R. W. Smith, *Systems Engineering Using SDL-92*. Amsterdam, the Netherlands: Elsevier Science B.V., 1994.¹¹

⁸An introductory text on SDL, also useful as a language reference (for SDL-88).

⁹A recently published book, which appears to be the most comprehensive single-volume introduction and reference for SDL-92, including its object-oriented extensions.

¹⁰This provides a summary of the changes from SDL-88 to SDL-92.

¹¹A detailed guide to using SDL-92, including a thorough explanation of abstract data type mechanism and SDL combined with ASN.1 (ITU-T Recommendation Z.105).