ETSI TECHNICAL REPORT

ETR 293-2

June 1998

Source: TETRA

Reference: DTR/TETRA-04012-2

ICS: 33.020

Key words: TETRA, protocol, validation, SDL, PDO

Terrestrial Trunked Radio (TETRA); Air Interface (AI) layer 2 and 3 protocol validation; Part 2: Validation of SDL models for Packet Data Optimized (PDO)

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
Internet: secretariat@etsi.fr - http://www.etsi.fr - http://www.etsi.org

Tel.: +33 4 92 94 42 00 - Fax: +33 4 93 65 47 16

Contents

Foreword 5

1 Scope 7

2 References 7

3 Definitions and abbreviations 7
3.1 Definitions 7
3.2 Abbreviations 7

4 Introduction 8

5 General 8
5.1 The validation principles 8
5.2 Validation architecture 10
5.3 The validation process 11
5.3.1 Protocol validation process 11
5.3.2 Protocol stack validation process 11
5.3.3 Validation result analysis 12
5.3.4 Tool support 12
5.4 Documentation of the validation process 12
5.5 Validated protocols 13

6 Protocol validation 14
6.1 MM entity 15
6.1.1 Validation purposes 15
6.1.1.1 Registration 15
6.1.1.2 Group attachment - detachment 15
6.1.2 Options, constants and parameters 15
6.1.3 Validation results 16
6.2 CONP entity 23
6.2.1 Validation purposes 23
6.2.1.1 Data transfer 23
6.2.2 Options, constants and parameters 23
6.2.3 Validation results 23
6.3 SCLNP entity 25
6.3.1 Validation purposes 25
6.3.2 Options, constants and parameters 25
6.3.3 Validation results 25
6.4 MLE entity 31
6.4.1 Validation purposes 31
6.4.1.1 Attachment management procedures 31
6.4.1.2 Data transfer 31
6.4.1.3 Network broadcast procedures 31
6.4.1.4 Management entity procedures 31
6.4.2 Options, constants and parameters 31
6.4.3 Validation results 32
6.5 Layer 2 entity 35
6.5.1 Validation purposes 35
6.5.1.1 Downlink - Acknowledged - Single SDU 35
6.5.1.2 Downlink - Acknowledged - Chained SDU 35
6.5.1.3 Downlink - Unacknowledged - Single SDU 35
6.5.1.4 Uplink - Acknowledged - Single SDU 35
6.5.1.5 Uplink - Acknowledged - Chained SDU 35
6.5.2 Options, constants and parameters 36
6.5.3 Validation results 36

7 Protocol stack validation 40
7.1 Validation purposes 40
7.2 Options, constants and parameters 40
7.3 Validation results 40

8 Validation result summary 41

Annex A: Validation files on floppy disk 42

History 43

Foreword

This ETSI Technical Report (ETR) has been produced by the TErrestrial TRunked RAdio (TETRA) Project of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

This ETR consists of 3 parts as follows:

Part 1: "Validation of SDL models for Voice plus Data";

Part 2: "Validation of SDL models for Packet Data Optimized (PDO)";

Part 3: "Validation of SDL models for Security functions".

Blank page

1 Scope

This ETSI Technical Report (ETR) defines the methods, procedures, and validation purposes used for the formal validation of the Specification and Description Language (SDL) model of TETRA Packet Data Optimized Interface and documents the results of the validation.

The validation of the TETRA SDL-specifications inside the scope of this ETR covers the TETRA Air Interface, layer 2 and 3 protocols for Packet Data Optimized.

2 References

For the purposes of this ETR the following references apply:

[1] ETS 300 393-1 (November 1995): “Radio Equipment and Systems (RES); Trans-European Trunked RAdio (TETRA) system; Packet Data Optimized; Part 1: General network design”.

[2] ETS 300 393-2 (November 1995): “Radio Equipment and Systems (RES); Trans-European Trunked RAdio (TETRA) system; Packet Data Optimized; Part 2: Air Interface”.

[3] ITU-T Recommendation Z.100 (1993): “Specification and description language (SDL)”.

[4] ITU-T Recommendation Z.120 (1993): “Message sequence charts”.

[5] ISO.8348: “Information processing systems - Data communications - Network service definition”.

[6] ISO.8878: “Use of X.25 to provide the OSI connection mode network service”.

[7] ISO.8648: “Information processing systems - Internal organisation of the network layer”.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this ETR, the following definitions apply:

validation case: A sequence of validation events designed to achieve a particular validation purpose.

validation model: A model for the protocol specified with a formal description technique, in this case, SDL.

validation purpose: A single requirement of a protocol in the scope of validation.

validation script: A validation case or a subset of it presented in a manner that can be used to activate and trace the protocol transitions in execution of the validation model.

3.2 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

BS	Base Station
CC	Call Control sub-entity within CMCE
IE	Information Element
GTSI	Group TETRA Subscriber Identity
ITSI	Individual TETRA Subscriber Identity
LLME	Lower Layer Management Entity
MCC	Mobile Country Code

MLE	Mobile Link Entity
MM	Mobility Management
MNC	Mobile Network Code
MNI	Mobile Network Identity
MS	Mobile Station
MSC	Message Sequence Chart
PDU	Protocol Data Unit
QoS	Quality of Service
RPDI	Radio Packet Data Interface
SCLNP	Specific Connectionless Network Protocol
SAP	Service Access Point
SDL	Specification and Description Language
SDS	Short Data Services sub-entity within CMCE
SDU	Service Data Unit
SP	Service Primitive
SSI	Short Subscriber Identity
TDMA	Time Division Multiple Access
TEI	TETRA Equipment Identity
TETRA	TErrestrial Trunked RAdio
TL-SDU	SDU from the LLC service user, i.e. MLE
TLA-SAP	A layer 2 Service Access Point
TLB-SAP	A layer 2 Service Access Point
TLC-SAP	A layer 2 Service Access Point
TSI	TETRA Subscriber Identity
V+D	Voice plus Data

4 Introduction

This ETR documents the validation of the TETRA protocols for the PDO Air Interface, ETS 300 393-2 [2]. The overall purpose of the validation is to check that the required service and protocol functionality is supported by the specified protocols of the MS side.

The validation of the protocols under the scope of this ETR has been performed using the latest specification methodologies, techniques and tools available.

Code generation was used to create an executable validation model from the SDL specification. The executable validation model was then used for simulation against the selected set of protocol requirements. The simulation was performed using advanced simulation techniques, including Message Sequence Chart (MSC) trace generation.

During the specification and simulation of the validation model a number of minor errors and inefficiencies in the protocol descriptions were identified. These errors and inefficiencies are documented, and generally a proposal for solution is given in this ETR. The validation has demonstrated that an operational TETRA PDO Air Interface protocol stack can be implemented according to ETS 300 393-2 [2].

5 General

5.1 The validation principles

The validation of the required service functionality is performed using a set of selected requirements, derived from the textual protocol specifications. The selected requirements are expressed in terms of validation cases. Also a validation model is derived from the same textual protocol specifications. This validation model should reflect correctly the defined protocol behaviour. These principles are illustrated in Figure 1.

The purpose of the validation is to check if the validation model satisfies the selected requirements, and hence if the protocol descriptions correctly define the service functionality. Use of two independent formalizations of the textual standard improves the probability that the protocol description is consistently expressing the validated requirements.

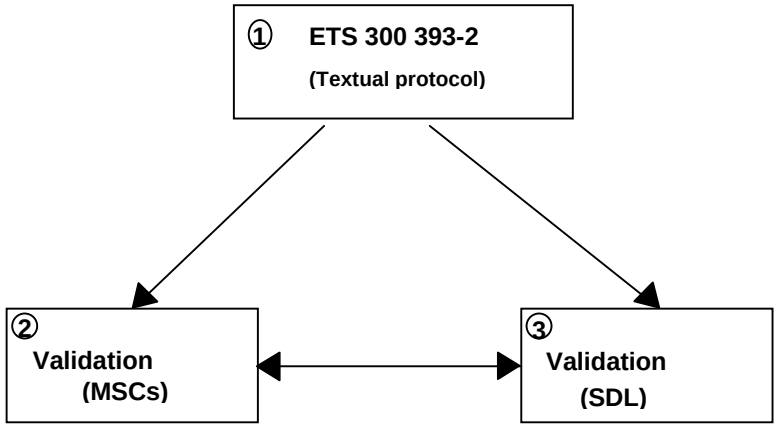

Figure 1: The principle of the validation process

The value of validation using this approach is heavily dependent on the quality of the mapping from the selected requirements of the textual protocol specification to the validation cases representing the validation requirements. However it is necessary to formalise the textual protocol specification in order to allow the validation process to be carried out by computer tools. The formalization is done by converting the textual protocol specification into SDL and expressing the validation cases in terms of MSCs.

The requirements for a protocol can be categorised into three different classes referring to the following three aspects of protocol validation:

1) service validation;
2) protocol validation;
3) protocol stack validation.

Service validation is checking that the requirements at the service interface are satisfied by a single protocol entity.

Protocol validation includes single protocol entity validation and peer-to-peer validation. Single protocol entity validation is concentrated on the mapping between service primitives and PDUs. Additionally, peer-to-peer validation covers the PDU exchange between peer entities.

Protocol stack validation is validation of protocol entities of different layers linked together.

5.2 Validation architecture

The general outline of the validation performed is illustrated in Figure 2, where also the relationship with the three concepts of Figure 1 is indicated.

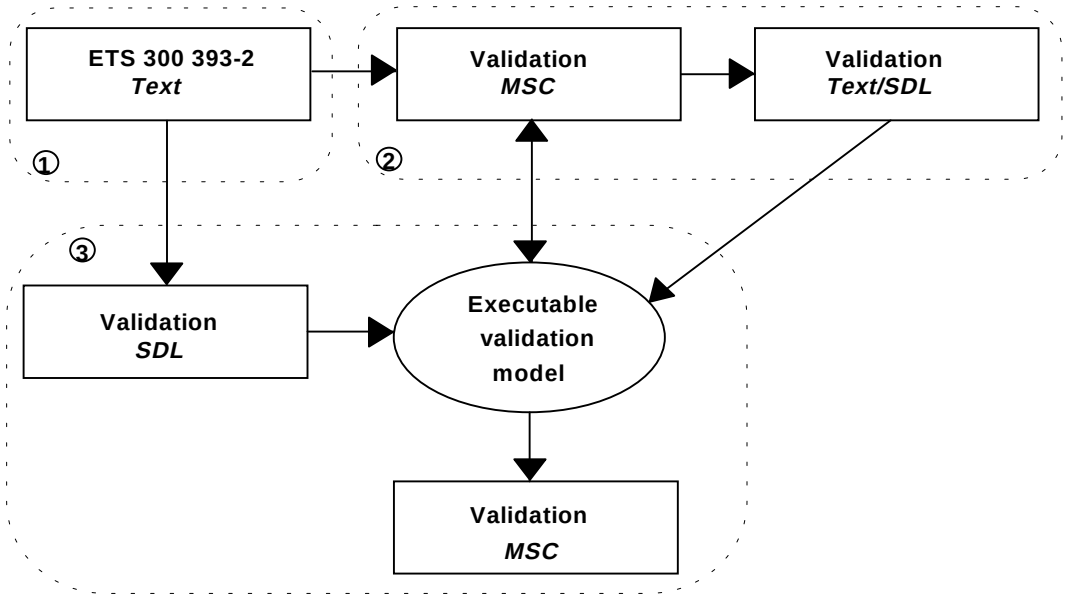

Figure 2: Architecture of the validation

The validation model and the validation cases are established based on the textual protocol specification.

The validation model is implemented as SDL specifications for each protocol as recommended by ITU-T Recommendation Z.100 [3]. Validation cases and validation traces are presented as MSC-diagrams. MSC-diagrams follow the corresponding ITU-T Recommendation Z.120 [4].

All important requirements of the protocols must be expressed in the scope of validation purposes and thus, also in the validation cases. Additionally, an MSC only specifies a single sequence of validation events. So for that reason a set of MSCs may be needed for the specification of one validation case.

An MSC of a validation case contains a representation of an N - service user, N - protocol, N - formatter, and (N-1) - service provider. So the protocol events, i.e. N - SPs, N - PDUs and (N-1) - SPs can be traced from an MSC respectively.

Hence validation of protocol behaviour requirements is done in terms of the protocol events of the validation cases. In addition, requirements on the data part of the protocols must be validated. An exhaustive validation is not feasible due to the number of combinations of data values. So a limited number of combinations of data values are selected. The particular data values selected should ensure that all unique behaviours of the protocol are validated.

To perform the validation, the validation model has to be made ready for simulation, i.e. executable. This is done automatically by the tools used for the validation.

In order to perform the simulation, a set of validation scripts has been derived from the validation cases. This has been done by providing all the necessary signals and parameters to make a validation case executable in combination with the executable validation model. In addition, the validation scripts contain commands to configure the simulation environment, e.g. breakpoint settings. Since the format of the validation scripts is tool-dependent and the scripts are only used to send the necessary protocol events already presented in the validation cases to the executable validation model, they are not part of the documentation of the validation process.

Finally, validation traces can be produced by executing the validation model. These traces are then compared to the validation cases and the result analysis of the validation follows.

Only validation traces of the whole protocol stack are included in the documentation of the validation process, since also protocol events of the individual protocol entities can be extracted from these traces.

A minimum requirement for the validation performed is that all parts of the validation cases have been verified at least once during the validation.

NOTE: The validation is restricted to the MS side of the protocols, but a parallel model for the BS side is made for simulation purposes solely. Due to this, the BS model is not part of the validation documentation.

5.3 The validation process

To accomplish the validation results, the following validation scheme has been used to implement the validation principles described in sub-clause 5.1:

- protocol validation process;
- protocol stack validation process.

In this scheme the service validation is performed in two parts.

First part of the service validation is performed as part of the protocol validation, when the SP - PDU relationship inside a protocol entity is validated.

Second part of the service validation is performed while incrementally validating the protocol stack. That is when the interaction between a protocol entity and the one above it inside one stack is validated.

For the highest service interface inside the scope of the validation, the service validation is done manually during the validation sessions, e.g. validation script acting as a service user of the protocol.

So following this scheme validation results for all three categories of requirements (service, protocol, and protocol stack) are achieved.

5.3.1 Protocol validation process

The protocol validation process is divided into two phases:

- single protocol entity validation;
- peer-to-peer validation.

First phase is to validate the MS entity of the protocol. This is where the relationship between the services provided by the protocol and PDUs sent and received is validated.

Peer-to-peer validation is performed between the MS and the BS entities of the same protocol. In this phase, protocol requirements for the PDU exchange are validated.

NOTE: It may not be obvious how the peer-to-peer validation is performed if the validation cases describe only the MS side. However, this is possible, since the MSCs include both incoming and outgoing PDUs, and thus describe the requirements of the actual protocol.

5.3.2 Protocol stack validation process

The validation of the protocol stack is done in an incremental way. Initially, a layer by layer validation is performed. Validation of the complete stack is then performed.

Protocol stack validation is based on the same validation cases as the ones used for individual protocol validation. To verify correct protocol stack behaviour, more than one validation case may have to be used.

5.3.3 Validation result analysis

If a validation case can be verified by execution of the validation model, it is assumed that the textual protocol description has correctly defined the corresponding validation purpose. However, if an error is detected during the validation the following procedure is applied:

1) check if the validation case consistently reflects the selected requirement of concern in the textual protocol specification. If the MSC is incorrect, it is updated and the validation execution is repeated;

2) if the error detected is an error in the validation model of the protocol, the SDL specification is updated and the validation execution is repeated;

3) if the cause of the non-conformance detected by the validation is due to a contradiction, omission, or inefficiency in the textual protocol standard, a proposed solution is implemented in the validation model. However, for a final solution to such “errors” a resolution from the responsible party must be provided.

5.3.4 Tool support

The validation is performed using the advanced facilities of the SDT SDL tool. This includes the simulator and support for MSC trace generation, and automated check of validation scripts against the executable validation model.

Also, the tool is used to ensure that the SDL models of the protocols comply with the syntax and semantics of the SDL language.

5.4 Documentation of the validation process

The documentation of the validation contains the following information:

- validation purposes;
- options, constants and parameters used in the validation;
- validation cases;
- validation results.

The validation purposes lists the requirements selected for validation for each protocol entity and so identifies the validation cases used.

Optional features in the protocol are presented here in a table giving the values used while running the validation sessions.

The validation cases for each protocol entity are included in this document in annex A. The same validation cases are used also for the protocol stack validation.

The SDL - validation model is given on the diskette attached to this document. Files included and their formats are described in annex A.

A summary of the validation results is given in clause 8.

5.5 Validated protocols

The TETRA PDO SDL protocol specifications validated are shown in table 1.

Table 1: The protocols validated

Protocol	Validation
CONP	Service Protocol Protocol stack
MM	Service Protocol Protocol stack
SCLNP	Service Protocol Protocol stack
MLE	Service Protocol Protocol stack
Layer 2	Service Protocol Protocol stack

Since the SCLNP and CONP are already standardised protocols, the validation of these protocols concentrates on their interaction with underlying layers.

6 Protocol validation

The following subclauses describe the validation purposes, parameters used and the validation results for each validated protocol entity.

The validation purposes are introduced by textual means, while the validation cases specified as MSCs can be found as specified in annex A for each protocol entity.

The option, constant and parameter values used in the model are shown together with the ranges stated in the textual protocol specification, i.e. some restrictions may apply for the validation model and not all values mentioned in the textual protocol specification may have been used in the validation.

A special format is used to present the validation results. All the results for each protocol are collected to a series of tables with the following fields present.

1) **No.**, which contains the name of the protocol considered and a running number for a reference inside the series of the protocol validation results;

2) **Reference**, or references, which always refer to the textual protocol specification ETS 300 392-2 [2], unless otherwise stated;

3) **Category**, which can be one of the following is recommended:

- normative, when the validation result found is related to the normative part of the protocol specification;
- informative, when the validation result found is related to informative parts of the protocol specification, e.g. most of the service primitives;
- editorial, in case of spelling mistakes or otherwise obvious or minor inconsistency found.

4) **Item**, which defines the specific subject as explicitly as possible;

5) **Validation decision**, which defines the solution for validation model. This field may marked as N.A., if the validation result does not reflect any requirements for the validation model;

6) **NOTE**-field may be present for additional information and applicability of the subject;

No table headings are used, since the **No.**-field is used as a reference to a specific table.

6.1 MM entity

6.1.1 Validation purposes

The validation purposes for Mobility Management (MM) are concentrated on the basic functionality of the different registration types.

6.1.1.1 Registration

The following purposes are defined for handling mobile registration.

1) activation;
2) registration;
3) deregistration;
4) energy economy mode;
5) disable.

6.1.1.2 Group attachment - detachment

The following purposes are defined for handling group number Attachment - Detachment.

1) User Attachment - detachment of group identities.

6.1.2 Options, constants and parameters

Table 2: Constant and parameter values used in the validation of MM

Name	Values used	Range	Remarks
HOME_ITSI	357 975 4545	NOTE	The Home ITSI number (MCC, MNC, SSI)
TEI	774488	NOTE	The TETRA Equipment Identity (TEI) number
DUPLEX_SUPPORTED	TRUE	TRUE/FALSE	The value is used in Class Of MS
TETRA_AIR_INTERFACE_STANDARD_VERSION_NUMBER	0	0-7	The value is used in Class Of MS
SCLNP_SUPPORTED	TRUE	TRUE/FALSE	The value is used in Class Of MS
CONP_SUPPORTED	TRUE	TRUE/FALSE	The value is used in Class Of MS
T.351	30	30 Sec.	Registration Timer
NOTE: For definition see ETS 300 392-1 Clause 7 [1].			

6.1.3 Validation results

The results show that the MM protocol is functional. There are a few comments that could increase the readability of the MM protocol description in ETS 300 393-2 [2].

No.	MM 1	**Reference**	7.3.2 - ETS 300 393-2	**Category**	Normative
Item					
In the ETS 393-1, 7.3.2, “forwarding” is mentioned in this clause. “Forward registration” in V+D is only applied during a circuit call to achieve a shorter hand-over period in some cell reselection situations. Referring to the PDO requirements, a circuit-mode call is not supported at all; together with the withdrawal of the Type-1 announcement cell reselection as shown in the V+D part, both reasons imply that “forwarding” should not be supported by the PDO part.					
Validation decision					
Forward registration is not described in the validation model.					
NOTE:					

No.	MM 2	**Reference**	16 - ETS 300 393-2	**Category**	Normative
Item					
In various places in clause 16, the term “circuit mode call” has been used. The definition of this term is not clear. Can the term “circuit mode call” be applied only on a circuit mode call, as provided by the CMCE in the V+D part; or, on a virtual connection offered by the CONP; or both? If this term is applied on the first reason only, it should be removed from the document, as the CMCE is not supported by the PDO part.					
Validation decision					
The validation was based on the assumption that a CONP virtual connection not defined as a “circuit model call”.					
NOTE:					

No.	MM 3	**Reference**	16.9.12 - ETS 300 393-2	**Category**	Normative
Item					
If a “circuit mode call” (see MM 2) is not supported in the PDO part (i.e. a CONP virtual connection is not considered as a “circuit mode call’), two values for the “location update type” should be removed - “Call restoration roaming location updating” and “Call restoration migrating location updating”.					
Validation decision					
Both values are not used in the validation model.					
NOTE:					

No.	MM 4	**Reference**	16.4.2 - ETS 300 393-2	**Category**	Normative
Item					
Under the paragraph of “No new ITSI”, the location update type is not defined.					
Validation decision					
If the user application is not requesting forward registration to a new system (see MM 1), the location update type shall be set to “periodic location updating”. When forward registration is requested, the location update type shall be set to “migration location updating”, or if there was an active circuit mode call, to “call restoration migration updating” (see MM 3).					
NOTE: This decision is also applied on V+D as shown in the 16.4.2 of ETS 392-2.					

No.	MM 5	**Reference**	16.8.2.1 - ETS 300 393-2	**Category**	Normative
Item					
The IE “Command” in the PDU “D-Group Identity Command” is not defined in the ETS 393-2. According to the descriptions of the network-initialised group identity download function from the 7.7 ETS 393-1, this IE should contain the values defined as `Add’, `Delete GSSI list’, `Delete All’, and `Report’.					
Validation decision					
The validation model supports this IE as suggested above.					
NOTE:					

No.	MM 6	**Reference**	16.9.24 - ETS 300 393-2	**Category**	Normative
Item					
The requirements for the group address handling capability of the PDO part are confusing. It is well understood that group addresses should only be downloaded from the RPDI, but not uploaded from a MS. However, there is no consistent descriptions, from both ETS 393-1 and ETS 393-2, to define clearly if it is MS or RPDI, or even both entities are capable to initiate the group address download procedure. Referring to the clause 7.7 in the ETS 393-1, only network-initialised cases are described, and similar descriptions may also be found from the clause 16.7 of the ETS 393-2. In fact, only PDUs 'D-Group Identity Command' and 'U-Group Identity Acknowledge' are supporting the network-initialised group address download function only, This, however, contradicts to the clause 16.4.1/2/3 in the ETS 300 393-2 where a MS is allowed to initiate group address download function during a registration procedure. (Further details of the problem in registration procedures may be found in MM x.) Nevertheless, the IEs corresponding to group address functions in the PDUs "U-Location Update Demand" and "D-Location Update Accept" are exactly the same as those in the V+D part, but not modified or removed according to the different requirements of the PDO part. That creates even more confusion over the functional requirements of group address handling.					
Validation decision					
As there is no obvious hint from the documents to explicitly describe that a MS is allowed to initiate group address download functions (i.e. no dedicated PDUs for this purpose), it is therefore decided that only the feature of network-initiated group address download function is supported. This decision forms the basis as such influencing some of the following change requests.					
NOTE:					

No.	MM 7	**Reference**	16.8.3.3 - ETS 300 393-2	**Category**	Normative
Item					
There is no detailed description for the procedure Group Identity Network Download. The PDU priority value set for conveying the PDU 'U-Group Identity Acknowledge' in the MLE-UNITDATA request is undefined.					
Validation decision					
A new paragraph may be added after the existing one. The wording may be as shown: "Upon receipt of the MLE-UNITDATA indication with D-Group Identity Command PDU, the MM entity shall check the information element 'command', inside the PDU. For the case where the command is 'Add' or 'Delete List', MM shall also check the information element 'New GSSI', which may me repeatable. When the command is 'Delete All', the MM entity will remove all existing GSSIs in the mobile station. Afterwards, the MM entity shall send a U-Group Identity acknowledge PDU as a response, with the PDU priority set as 1 in the MLE-UNITDATA Request. If the command is 'report', all GSSI(s) in the mobile station will be put on the information element 'New GSSI', which is repeatable. If the operation is successful, the information element 'Accept/Reject' will be marked as 'Accept'. Otherwise, 'Reject' will be marked instead with the explanation on the information element 'reject reason'. The action of updating the GSSI list shall be done by sending the MLE-IDENTITIES request, containing the added or deleted GSSI(s), to the MLE entity."					
NOTE:					

No.	MM 8	**Reference**	16.8.3.3 - ETS 300 393-2	**Category**	Normative
Item					
As a result of MM [6] (i.e. the MS shall not initialise group address handling function), the IE 'Group Identity Location Demand' in the PDU 'U-Location Update Demand' should be removed.					
Validation decision					
This type-3 element 'Group Identity Location Demand' was removed from the model.					
NOTE:					

No.	MM 9	**Reference**	16.8.3.3 - ETS 300 393-2	**Category**	Normative
Item					
As a result of MM [6], together with the requirement of conveying a GSSIs report in the PDU 'U-Location Update Demand' as a response to the IE 'group address report' in the PDU 'D-Location Update Command', the existing IE 'Group Identity Location Demand Ack' should be replaced by the type-3 elements 'New GSSI'. The definition of the IE is as shown:					
<Information Element>	<Element Length>		<Element Type>	<C/O/M>	<Remark>
New GSSI			3	C	repeatable
Validation decision					
The IE 'New GSSI' now replaces the IE 'Group Identity Location Demand Ack' in the PDU 'U-Location Update Demand'.					
NOTE:					

No.	MM 10	**Reference**	16.8.3.1 - ETS 300 393-2	**Category**	Normative
Item					
The detail of the IE "Reject Reason" in the PDU 'U-Group-Identity-Acknowledge' is not defined.					
Validation decision					
The model leaves this IE undefined.					
NOTE:					

No.	MM 11	**Reference**	16.5 - ETS 300 393-2	**Category**	Normative
Item					
As the layer 2 does not support the acknowledged response service, the PDU D-STATUS is no longer sent from a BS to respond to the PDU 'U-ITSI DETACH' in the De-registration procedure. The MS now only waits the MLE-REPORT indication before de-activation.					
Validation decision					
N/A					
NOTE:					

No.	MM 12	**Reference**	16.9.24 - ETS 300 393-2	**Category**	Normative
Item					
The Type-3 element identifier definitions are all stated as reserved.					
Validation decision					
New Registered Area (0010_2)* Proprietary (0100_2)* Security (0110_2)* New GSSI (0111_2)					
NOTE:* These type-3 elements, identical to their counterparts in the V+D part, are assigned with the discriminator values as in the ETS 392-2 16.10.51.					

No.	MM 13	**Reference**	16.9.16 - ETS 300 393-2	**Category**	Normative
Item					
The PDU 'D-ENERGY SAVING' is not assigned with a PDU discriminator value.					
Validation decision					
The PDU is now assigned with a value 1101_2.					
NOTE:					

No.	MM 14	**Reference**	16.8.2.1 - ETS 300 393-2	**Category**	Normative
Item					
The element length of “command” is 1, which is not sufficient to support four values - Add, Delete List, Delete All and Report.					
Validation decision					
The element length of “command” should be 2.					
NOTE:					

No.	MM 15	**Reference**	15 - ETS 300 393-2	**Category**	Informative
Item					
The service primitive “TNMM_Service_Indication” is not found in PDO. This results in no possible way for the user application to access the current service status / disable status.					
Validation decision					
The service primitive, with a parameter list of service status and disable status, is implemented in the SDL model.					
NOTE: This decision is also applied on V+D as shown in the 15.3.3.8 of ETS 392-2.					

No.	MM 16	**Reference**	15 - ETS 300 393-2	**Category**	Informative
Item					
There is no MM service primitive providing the GSSI information to the user application. As a result, a user application is unable to obtain dynamic GSSIs information downloaded from the network infrastructure. A user may only use the pre-defined GSSIs stored on the subscription card, for example.					
Validation decision					
A service primitive, TNMM-Group Identity Acknowledgement, with a list of GSSIs may be introduced.					
NOTE:					

No.	MM 17	**Reference**	15.3.4 - ETS 300 393-2	**Category**	Informative
Item					
The registration type for the service primitive “TNMM-REGISTRATION request” are defined as follows: new location area, new network, with authentication, power on, SIM in, user demand; however, these options are not mutually exclusive. For example, a user may request registration with authentication when a MS is powered on. According to 16.4.2 in the ETS 300 393-2, the registration type may be concluded as “No new ITSI”, “New ITSI” and “New ITSI - forwarding”, if forwarding is supported (See MM 1)					
Validation decision					
In the validation model defines the parameter “Registration Type” as ITSI, ITSI-forwarding (only if forwarding registration is supported <see MM 2>) and NoITSI.					
NOTE: This decision has also been applied on the V+D part as shown in the 16.4.2 of ETS 392-2.					

No.	MM 18	**Reference**	15.3.3 - ETS 300 393-2	**Category**	Informative
Item					
The parameters for the TNMM-SAP service primitives are defined with insufficient detail. Although the parameters are of informative nature, a reader may find the service primitives more comprehensible if the table 44 describes the status (i.e. mandatory/conditional/optional) of each service primitives.					
Validation decision					
N/A					
NOTE:					

No.	MM 19	**Reference**	15.3.3 - ETS 300 393-2	**Category**	Informative
Item					
Comparing the PDO with the V+D, it is found all common service primitives are functioning in the same manner. It is suggested to adopt the parameter list used in V+D for those common service primitives to increase the re-use factor. The common service primitives are: TNMM-Deregistration indication/request, TNMM-DISABLING indication, TNMM-ENABLING indication, TNMM-ENERGY request/confirm and TNMM-REGISTRATION confirm/indication/request.					
Validation decision					
The model is now adopting the V+D's parameters list of the common TNMM-SAP service primitives.					
NOTE:					

No.	MM 20	**Reference**	16.9.8 - ETS 300 393-2	**Category**	Editorial
Item					
The length of LACC, 14, is found inconsistent with that in 16.9.9, in which the value is 10.					
Validation decision					
The length of LACC should be 10.					
NOTE: This decision is based on the identical address units used in the V+D part.					

No.	MM 21	**Reference**	16.8.2.6 - ETS 300 393-2	**Category**	Editorial
Item					
The PDU "N UPDATE COMMAND" should be replaced by "D-LOCATION UPDATE COMMAND"					
Validation decision					
N/A					
NOTE:					

No.	MM22	**Reference**	7.6.1.2.1 - ETS 300 393-1	**Category**	Editorial
Item					
"When roaming, the process..." should become "When migrating, the process..."					
Validation decision					
N/A					
NOTE:					

No.	MLE 23	**Reference**	18.3.4.7 - ETS 300 393-2	**Category**	Editorial
Item					
"Announced cell re-selection is divided into three ..." should become "Announced cell re-selection is divided into two ..." Only type 2 and 3 announced cell reselection are supported in the PDO part.					
Validation decision					
N/A					
NOTE:					

No.	MM 24	**Reference**	16.9.16 - ETS 300 393-2	**Category**	Editorial
Item					
The PDU 'D-Group Identity Download' should be renamed as 'D-Group Identity Command' for consistency.					
Validation decision					
N/A					
NOTE:					

No.	MM 25	**Reference**	16 - ETS 300 393-2	**Category**	Editorial
Item					
The description of the Enable / Disable procedures are missing in this clause. A clause should be added to describe the involvement of service primitives and PDUs. As it is assumed that these two procedures are identical to those in the V+D part, a new clause describing the enable and disable procedures, as in 16.5 of ETS 392-2, should be added to the clause 16 in ETS 393-2.					
Validation decision					
The model defines the procedures of Enable and Disable as in 16.5 of ETS 392-2.					
NOTE:					

No.	MM 26	**Reference**	15.3.3 - ETS 300 393-2	**Category**	Editorial
Item					
The status of the IEs of the PDU “U-Group-Identity-Acknowledgement” are not defined. They will be mandatory, for IE ‘Message identifier’ and IE ‘Accept/reject’; conditional, for IE ‘Reject reason’; and optional, for IE ‘New GSSI’.					
Validation decision					
N/A					
NOTE: The IE “Reject reason” will be mandatory, if IE “Accept/reject” is Accept.					

No.	MM 27	**Reference**	16.8.2.1 - ETS 300 393-2	**Category**	Editorial
Item					
The length of ISSI is 29.					
Validation decision					
An ISSI should be 24 of length.					
NOTE:					

No.	MM 28	**Reference**	16.9.16 - ETS 300 393-2	**Category**	Editorial
Item					
The PDUs “U-Attach/Detach Group Identity” and “U-Attach/Detach Group Identity Acknowledgement” should be removed.					
Validation decision					
N/A					
NOTE:					

No.	MM 29	**Reference**	16.8.3.1 - ETS 300 393-2	**Category**	Editorial
Item					
The detail of the IE “Accept/Reject” is not explained. It is assumed that this IE indicates if the PDU “D-Group Identity Command” it responds to is accepted or not. The value of the IE “command” in the PDU “D-Group Identity Command” shall not affect the status of the IE “Accept/Reject”. As stated on the table 55 in 16.8.3.1, this IE is of element type 1 (i.e. mandatory).					
Validation decision					
The model describes this IE as Accept or Reject.					
NOTE:					

No.	MM 30	**Reference**	16.4.1/2/3 - ETS 300 393-2	**Category**	Editorial
Item					
In 16.4.1, the phase “Finally the PDU may include request for attachment/detachment of group identities...” was found twice in this clause. In 16.4.2, the phase “Finally the PDU may include request for download of group identities…” was found three times in this clause. In 16.4.3, the phase “…and the MS shall not request a group identity report” was found once. Following the arguments and decision made on MM 6, the above phases should be removed from the ETS 300 393-2.					
Validation decision					
N/A					
NOTE:					

No.	MM 31	**Reference**	16.7 - ETS 300 393-2	**Category**	Editorial
Item					
Figure 53 does not show the involvement of service primitives exchange.					
Validation decision					
The PDUs “D-group identity command” and “U-group identity acknowledgement” should be conveyed by the service primitives “MLE-UNITDATA indication” and the “MLE-UNITDATA request” respectively. Also, if the list of GSSI has been modified successfully, the MM should send “MLE-Identity request” to the lower layer to update the list. In this case, the PDU priority is set to 6.					
NOTE:					

6.2 CONP entity

6.2.1 Validation purposes

The validation of the CONP has been done with the scope to validate the use of the TETRA Air-Interface and not the X.25 standard.

6.2.1.1 Data transfer

The following purposes are defined for handling data transfer.

1) set-up a virtual connection;
2) data;
3) clear a virtual connection.

6.2.2 Options, constants and parameters

N.A.

6.2.3 Validation results

The validation of the CONP is a validation of the use of the TETRA Air Interface. In that scope the validation shows some changes needed.

No.	CONP 1	**Reference**	12.5	**Category**	Informative
Item					
The first paragraph "The protocol functions shall be (clause 11):", the meaning of this paragraph is unclear.					
Validation decision					
N.A.					

No.	CONP 2	**Reference**	12.5	**Category**	Informative
Item					
The sentence "the messages sent by the Application may be eventually segmented in packets in three user data of 4096 bytes maximum." Why is the number of packets three?					
Validation decision					
N.A.					

No.	CONP 3	**Reference**	12.6.1	**Category**	Informative
Item					
In this clause some MLE-RESET primitives are shown, without any description of their use.					
Validation decision					
Not used in this SDL model.					

No.	CONP 4	**Reference**	12.6.2	**Category**	Informative
Item					
The meaning of the paragraph “Only mapping of priority is done on the air interface as defined in quality of service.” is unclear. Even if the paragraph may imply the mapping of the priority value given in CONP Quality of Service (QoS) to CONP queuing priority, the value used for the PDU priority inside the MS protocol stack remains unclear.					
Validation decision					
N.A.					

No.	CONP 5	**Reference**	12.6	**Category**	Informative
Item					
It is not described which of the layer 2 services the CONP should use as described for the other layer 3 protocols: acknowledged request or unacknowledged.					
Validation decision					
The CONP always uses the acknowledged requests.					

No.	CONP 6	**Reference**	12.6.1	**Category**	Informative
Item					
It is stated that CONP should be able to receive the MLE-REPORT indication service primitive. No description is provided on how the protocol should react to the parameter value conveyed by the service primitive.					
Validation decision					
No reaction except for reception of the MLE-REPORT indication SP is specified in the validation model.					

No.	CONP 7	**Reference**	11.4.7.1	**Category**	Informative
Item					
It is stated "…but new values can be added". This is unclear.					
Validation decision					
N.A.					

No.	CONP 8	**Reference**	11.4.7.2	**Category**	Informative
Item					
This clause is not clear.					
Validation decision					
N.A.					

No.	CONP 9	**Reference**	12.4.4	**Category**	Informative
Item					
Figure 25 shows reset and restart sequences, whereas the title says only "Procedures for restart"					
Validation decision					
N.A.					

No.	CONP 10	**Reference**	12.4.4, 11.4.5.1	**Category**	Informative
Item					
Figure 25 shows restart sequences which are different from the diagram in figure 24.					
Validation decision					
N.A.					

6.3 SCLNP entity

6.3.1 Validation purposes

As SCLNP is a simplified protocol of ISO connectionless-mode network protocol, ISO.8648 [7], the validation has been concentrated on mapping the SCLNP Service Access Point (SAP) primitives to PDUs and vice versa. In addition to validating the service primitives the mapping with underlying MLE acting as a service provider is also validated.

Following validation cases have been made to validate MS SCLNP data transfer service:

1) receiving data packets from RPDI;
2) sending data packets to RPDI;
3) requesting and receiving delivery reports from RPDI.

6.3.2 Options, constants and parameters

Options, constants and parameters used in the validation in SCLNP are given in the following table.

Table 4: Constant and parameter values used in the validation of SCLNP

Name	Values used	Range	Remarks
SCLNP_RESENDS_AFTER_CLOSE	FALSE	TRUE..FALSE	Packet resending after MLE-CLOSE/OPEN pair
CURRENT_MNI	357 999	NOTE	The Mobile Network Identity (MNI) of the current network (MCC, MNC)
TETRA_AIR_INTERFACE_STANDARD_VERSION_NUMBER	0	0-7	Used in PDU header
NOTE: For definition see ETS 300 393-1 Clause 10 [1].			

6.3.3 Validation results

The results show that the SCLNP can function without structural changes needed in the PDUs. Major number of the reports indicate editorial changes to increase the readability of the textual description of SCLNP. In a summary, a fully functional SCLNP can be constructed from the description of ETS 300 393-2 [2].

No.	SCLNP 1	**Reference**	13.2.3.1, 13.3.4.2, 14.5.2.4	**Category**	Normative
Item					
In sub-clause 13.2.3.1 the maximum length of NSDU is stated to be 2048 octets. The minimum can be understood to be 0 since the NSDU and NSDU LENGTH parameters in TN-UNITDATA primitives in sub-clause 13.3.4.2 table 32 are marked as conditional. However, in the sub-clause 14.5.2.4 the Packet length that should be same as NSDU LENGTH in corresponding primitive has been stated to have values from 1 to 2048. It is not clear what is the Packet length value supposed to be in case NSDU and NSDU LENGTH parameters have been omitted in the corresponding TN-UNITDATA request primitive. To correct the situation it is possible to redefine the Packet length value range to start from 0 or redefine the NSDU and NSDU LENGTH parameters to be mandatory and redefine the NSDU LENGTH value range to be from 1 to 2048.					
Validation decision					
The Packet length value range in PDUs is redefined to be 0 to 2048.					

No.	SCLNP 2	**Reference**	14.4.2, 14.4.3	**Category**	Normative
Item					
In sub-clause 14.4.2 table 37 and sub-clause 14.4.3 table 38 downlink PDU S2-DT is stated to contain Delivery/Store request and Report request fields. These fields have no meaning to MS since there is no S1-DEL PDU to send any disposition reports to RPDI. In the same way as Multicast Area Selection field in S1-DT PDU is marked as Reserved in S2-DT PDU the Delivery/Store request and Report request fields should be marked as Reserved in S2-DT PDU too.					
Validation decision					
The information from S2-DT PDU Delivery/Store request and Report request fields are copied to corresponding service primitives. However, no other actions are taken by the MS SCLNP.					

No.	SCLNP 3	**Reference**	14.10.4	**Category**	Normative
Item					
In the algorithm for checking checksum parameters the initialisation of checksum calculation variables C1 and C0 are incorrectly initialised to have the value of C0. Later in the calculation C0 is always set to value 0 and C1 to value C0. The (mod 255) note in the procedure C is not necessary.					
Validation decision					
The initialisation of C1 and C0 is set to 0 (zero) as in sub-clause 14.10.3 procedure A. The checksum calculation syntax is corrected to be the same as in sub-clause 14.10.3 procedure B.					
NOTE: In the validation model Intersystem PDU handling has not been implemented in the BS SCLNP and thus the header checksum algorithm described in sub-clause 14.10 has not been implemented either.					

No.	SCLNP 4	**Reference**	13.3.4.2, 14.5.4.4	**Category**	Informative
Item					
The REPORT REQUEST parameter as defined in sub-clause 14.5.4.4 is missing from the sub-clause 13.3.4.2 table 32 that describes TN-SCLNS SAP service primitives. Appearance of the REPORT REQUEST parameter should be conditional in TN-UNITDATA request and TN-UNITDATA confirm primitives.					
Validation decision					
The REPORT REQUEST parameter has been added into TN-UNITDATA request and confirms primitives as a conditional parameter.					

No.	SCLNP 5	**Reference**	13.3.4.2, 14.5.4.3	**Category**	Informative
Item					
The Multicast and Packet storage parameters listed in sub-clause 13.3.4.2 table 32 include the same information as Delivery/Store request parameter in the same facility's list. From sub-clause 14.5.4.3 it can be seen that the Delivery field acts like Multicast facility and that the Storage field acts like Packet storage facility.					
Validation decision					
The Multicast and Packet storage parameters have been removed from the facility list of TN-UNITDATA primitives. Only the Delivery/Store request parameter is used instead.					

No.	SCLNP 6	**Reference**	17.3.6, 13.3.4.2	**Category**	Informative
Item					
The QoS parameter in sub-clause 13.3.4.2 table 32 can not be derived for TN-UNITDATA-indication primitive. The corresponding MLE-UNITDATA indication primitive does not carry QoS value to SCLNP.					
Validation decision					
The QoS parameter in TN-UNITDATA indication parameter has not been used.					

No.	SCLNP 7	**Reference**	17.3.2.4, 13.3.4.2, 14.4.2	**Category**	Informative
Item					
Both DESTINATION ADDRESS and SOUCE ADDRESS parameters in sub-clause 13.3.4.2 table 32 need to be sent as part of the TN-UNITDATA indication primitive. It is stated in the notes below PDU header structure figures in sub-clauses 14.4.2 and 14.4.3 that “MLE sublayer adds a source address parameter to the uplink PDU and adds a destination address parameter to the downlink PDU.” This needs to be reflected in the MLE_UNITDATA_indication primitive (17.3.2.4), so that SCLNP can receive this information from MLE and send both DESTINATION and SOURCE address as part of the TN-UNITDATA indication primitive.					
Validation decision					
The DESTINATION ADDRESS parameter in TN-UNITDATA indication primitive has not been used. The DESTINATION ADDRESS was not included in the MLE_UNITDATA_indication primitive. This approach was taken because it simplifies the modelling and does not affect the behaviour.					

No.	SCLNP 8	**Reference**	13.3.4.3, 14.4.5	**Category**	Informative
Item					
The Multicast facility in sub-clause 13.3.4.3 table 33 can not be derived for TN-DELIVERY indication primitive. The corresponding S2-DEL PDU as described in sub-clause 14.4.5 does not contain information to fill Multicast facility in the primitive. Also, the Multicast facility has no real meaning for MS as it only receives TN-DELIVERY indications.					
Validation decision					
The Multicast facility in TN-DELIVERY indication primitive has not been used.					

No.	SCLNP 9	**Reference**	14.2.4.2, 14.7.7, 14.9	**Category**	Informative
Item					
In sub-clause 14.2.4.2 it is stated about fields that correspond to non-supported additional facilities that those fields should be ignored. On the other hand in sub-clause 14.7.7 in description about Discard PDU functionality it is stated that whole PDU should be discarded if a PDU is received which contains an unsupported facility.					
Validation decision					
There are only two sets of supported facilities. In SLIM protocol a subset of FULL protocol facilities is used. In sub-clause 14.9 about conformance it is stated that the implementation of FULL protocol is required to be conformant with the ETS 300 392-2 [2]. As a result there will never be unsupported facilities in SCLNP and therefore the discard of PDUs based on unsupported facilities is not required.					

No.	SCLNP 10	**Reference**	14.5.4.4, 14.5.4.5, 14.7.9.7	**Category**	Informative
Item					
In sub-clause 14.5.4.4 the 4th Report request bit is described to be reserved. However, in sub-clause 14.5.4.5 the 4th bit is described to be set for “error reports”. In sub-clause 14.7.9.7 a direct match between REPORT REQUEST and REPORT CLASS fields is described.					
Validation decision					
The 4th bit in REPORT REQUEST has been taken as ERROR REPORT bit in REPORT CLASS field.					

No.	SCLNP 11	**Reference**	14.7.1.4	**Category**	Informative
Item					
The derivation of AREA SELECTION field is not listed in the list of facility fields to be derived from the corresponding TN-UNITDATA request primitive.					
Validation decision					
AREA SELECTION facility field is copied into Multicast Area Selection field in S1-DT PDU.					

No.	SCLNP 12	**Reference**	14.7.3, 14.7.4	**Category**	Informative
Item					
TIMESTAMP field is not listed in the list of facility fields to be copied into the corresponding TN-UNITDATA indication and into the corresponding TN-DELIVERY indication primitives.					
Validation decision					
TIMESTAMP facility field is copied from data PDU into the corresponding TN-UNITDATA indication primitive and from delivery PDU into the corresponding TN-DELIVERY indication primitive.					

No.	SCLNP 13	**Reference**	14.8.2	**Category**	Informative
Item					
The information in 14.8.2 is not aligned with information on MLE services at LSCL SAP (17.3.2.3 and 17.3.2.4). MLE-DATA indication primitive is not defined. Also, there is a decision information how to select “unacknowledged” or “acknowledged request” layer 2 service from MLE. In the second rule it is stated that a uplink or downlink primitive that indicate “class 2” in the QoS parameter may be mapped to “unacknowledged” service. The definition of “class 2” Quality of Service is unclear.					
Validation decision					
The validation model does not have MLE-DATA indication primitive. The relation between QoS and layer two service is not used in the validation model.					

No.	SCLNP 14	**Reference**	13.2.3.2	**Category**	Editorial
Item					
At the end of sub-clause 13.2.3.2 it is stated that “The details of the additional facilities offered by a given network can be negotiated and examined using the facility negotiation primitives”. In SCLNP there are no distinct facility negotiation primitives. The only information that is given about supported facilities in each individual data packet is the PROTOCOL SUBSET parameter that tells whether the FULL or SLIM protocol is used.					
Validation decision					
This information has not been used.					

No.	SCLNP 15	**Reference**	13.3.4.1, 14.2.3	**Category**	Editorial
Item					
In the destination and source address types are described in sub-clause 13.3.4.1 to have the value of ISSI or GSSI. However, ITSI or Group TETRA Subscriber Identity (GTSI) should be used instead since ISSI and GSSI address types do not contain country and network code in them. The address types used in PDUs are described in sub-clause 14.2.3 to be of type Short Subscriber Identity (SSI) or TSI.					
Validation decision					
The destination and source address types are used as ITSI and GTSI in TN-SCLNS SAP service primitives.					

No.	SCLNP 16	**Reference**	14.2.7	**Category**	Editorial
Item					
In sub-clause 14.2.7 the timer service in Lower Layer Management Entity (LLME) is presented. However, no need for timers or other services provided by LLME are referenced in any other part of clauses 26 or 14.					
Validation decision					
This information has been ignored.					

No.	SCLNP 17	**Reference**	14.3, 14.4.1	**Category**	Editorial
Item					
In sub-clause 14.3 table 34 the DELIVERY PDU data content has been marked as ‘None’. Strictly speaking the data content actually contains up to two octets from the beginning of corresponding DATA PDU user data part. This has been correctly indicated in the sub-clause 14.4.1 table 36.					
Validation decision					
Does not affect the validation model.					

No.	SCLNP 18	**Reference**	14.4.1, 14.4.5	**Category**	Editorial
Item					
In sub-clause 14.4.1 table 36 the Dest Address field is marked as being a part of S2-DEL PDU. However, looking from sub-clause 14.4.5 only Source Address field should be existent.					
Validation decision					
Destination address has not been used in S2-DEL PDU.					

No.	SCLNP 19	**Reference**	14.5.2.3	**Category**	Editorial
Item					
In sub-clause 14.5.2.3 figure 176 the flag telling address being a LONG or SHORT is named as “LA”. Later in the description the field name is referred as “LS”. Everywhere else in the clause 27 the field is referred as “LA”. Following the same naming convention as for FULL/SLIM PROTOCOL flag is “FS” this LONG/SHORT ADDRESS should be named “LS”.					
Validation decision					
Does not affect the validation model.					

No.	SCLNP 20	**Reference**	14.5.4.5	**Category**	Editorial
Item					
The last sentence in the sub-clause 14.5.4.5 about disposition report generation only when a packet storage has been attempted is not connected to any particular disposition report. It is unclear to what report this text is connected.					
Validation decision					
The sentence should be a NOTE connected to one of the disposition reports listed in the sub-clause. In the validation model the BS SCLNP does not contain any packet storage functionality and therefore the information in the end of sub-clause 14.5.4.5 makes no difference. The implemented BS SCLNP can give any kind of disposition report and the value is passed in the MS SCLNP to the service user.					

No.	SCLNP 21	**Reference**	14.5.6, 14.7.2	**Category**	Editorial
Item					
In sub-clauses 14.5.6 and 14.7.2 DELIVERY PDU is stated to contain all of the user data if the corresponding data PDU contains “less than 2 octets”. This should be “less than or equal to 2 octets”.					
Validation decision					
DELIVERY PDU contains up to 2 first octets of user data from the corresponding data PDU.					

No.	SCLNP 22	**Reference**	14.7	**Category**	Editorial
Item					
In sub-clause 14.7 table 37 the reference numbers are out of date. Also, it is not stated where these numbers refer to.					
Validation decision					
Reference numbers are changed, e.g. 10.1 to 14.7.1, 10.2 to 14.7.2, etc. which are sub-clauses in the ETS 300 393-2 [2].					

No.	SCLNP 23	**Reference**	14.7.1	**Category**	Editorial
Item					
In the clause 14.7.1 it is stated that information to fill data PDU is taken from the associated TL-UNITDATA request primitive. This should be TN-UNITDATA request primitive.					
Validation decision					
Information is taken from TN-UNITDATA request primitive instead of TL-UNITDATA request primitive.					

No.	SCLNP 24	**Reference**	14.5.2.3, 14.7.1.3, 14.7.2.3	**Category**	Editorial
Item					
In sub-clause 14.5.2.3 FS FLAG is stated to have values FULL PROTOCOL = 0 and SLIM PROTOCOL = 1. Later in the sub-clause 14.7.1.3 it is stated that “If the facility fields contain valid information, this shall be indicated by setting the FS FLAG”. Further on it is stated that “FS FLAG shall be cleared” in the meaning that FS FLAG should be set to a value indicating SLIM PROTOCOL. In the current wording it is not very clear whether “FS FLAG shall be set” and “FS FLAG shall be cleared” means the actual bit in the air interface PDU or something logical. In the sub-clause 14.7.2.3 there is a similar unclear sentence about “...by setting the FS FLAG”.					
Validation decision					
The FS FLAG is set to indicate FULL PROTOCOL in the fist case and SLIM PROTOCOL in the latter case.					

No.	SCLNP 25	**Reference**	14.7.3, 14.7.4	**Category**	Editorial
Item					
In the sub-clauses 14.7.3 and 14.7.4 it is stated that “the current mobile network code shall be inserted to complete the source address parameter”. The ITSI address type contains also MCC in addition to MNC so the MCC should be inserted too to complete the long address format.					
Validation decision					
MCC of the current network is also inserted into SCLNP service primitives where short address format is used in corresponding PDUs.					

No.	SCLNP 26	**Reference**	14.7.9.5	**Category**	Editorial
Item					
In the clause 14.7.9.5 there is reference to sub-clause about AREA SELECTION field. This sub-clause number is out of date and should be updated to be 14.5.4.6 instead of being 14.5.4.5 as it is now.					
Validation decision					
Does not affect the validation model.					

No.	SCLNP 27	**Reference**	13.3.1	**Category**	Editorial
Item					
In the clause 13.3.1 the response primitive type is defined. Such a primitive type is not used in SCLNP.					
Validation decision					
Not relevant for validation model.					

No.	SCLNP 28	**Reference**	13.3.2, 13.3.4.1	**Category**	Editorial
Item					
In sub-clause 13.3.2 it is stated about TN-UNITDATA confirm primitive: “It only confirms the successful transfer of the NSDU to the infrastructure”. On the other hand in sub-clause 13.3.4.1 the TN-UNITDATA confirm parameter REPORT is described to have a Boolean value about success of a data transmission. From the current wording it can be understood that TN-UNITDATA confirm is allowed to be used only for positive reports. It should have been stated that if SCLNP service user gets a positive confirm it is only to confirm the successful transfer of the NSDU to the infrastructure.					
Validation decision					
The REPORT parameters in TN-UNITDATA confirm primitive is taken directly from corresponding MLE-REPORT indication primitive. That value can be either success or failure.					

No.	SCLNP 29	**Reference**	14.2.5	**Category**	Editorial
Item					
In the clause 14.2.5 the TSN-UNITDATA should be replaced by MLE-UNITDATA.					
Validation decision					
Not relevant for validation model.					

6.4 MLE entity

6.4.1 Validation purposes

The validation purposes for the MLE entity are structured according to the functional entities of the MLE entity, i.e. validation cases for the Attachment entity, the Data transfer entity, the Network broadcast entity, and the Management entity.

6.4.1.1 Attachment management procedures

1) activation;
2) deactivation;
3) undeclared cell reselection;
4) unannounced cell reselection;
5) announced type 3 cell reselection;
6) announced type 2 cell reselection;
7) scanning procedure;
8) monitoring procedure;
9) access handling to communication resources.

These validation purposes are applicable to LMM SAP and where relevant also to LCO and LSCL SAPs.

NOTE: Data transfer with LLC is represented in these validation cases in an abstract manner, since the exact operation is described in corresponding validation cases for data transfer. Therefore, e.g. data sending is represented always with TL-DATA request primitive and data reception with TL-DATA indication primitive.

Validation case 6 is applicable only if announced type 2 cell reselection and the D-NWRK-BROADCAST-PDU transmission are supported by RPDI.

6.4.1.2 Data transfer

1) Data transfer with MM, CONP and SCLNP entities

Validation case 1 is applicable to LMM-SAP and validation case 2 to LCO- and LSCL SAPs.

Note, that MM use L2 acknowledged service for data. For CONP and SCLNP, both acknowledged and unacknowledged services may be used.

6.4.1.3 Network broadcast procedures

1) Broadcast information reception
2) Neighbour cell enquiry

6.4.1.4 Management entity procedures

The functionality related to Management Entity is outside the scope of the textual protocol specification and therefore outside the scope of validation.

6.4.2 Options, constants and parameters

Table 3: Constant and parameter values used in the validation of MLE

Name	Values used	Range	Remarks
T.370	5 Sec.		Cell re-selection preparation response time
MAX_BL_SIZE	750		Selection criterion between Basic and Advanced Link (approx. 3 Time Division Multiple Access (TDMA) time slots worth of data)

6.4.3 Validation results

The MLE protocol description as defined in clause 18 of ETS 300 393-2 [2] functions with the changes indicated below. In addition a number of changes are proposed to increase readability and remove spelling mistakes.

No.	MLE 1	**Reference**	18.3.4.7.5. - ETS 300 393-2	**Category**	Normative
Item					
Since the MAC layer does not initiate the channel change, the PDU D-NEW-CELL from the RPDI shall not allow the value of “Follow MAC channel change”.					
Validation decision					
As a result, the value “Follow channel allocation in MAC header - 00_2” in the IE ‘Channel command valid’ should be marked as reserved.					
NOTE:					

No.	MLE 2	**Reference**	18.4.1 - ETS 300 393-2	**Category**	Normative
Item					
The PDU System Information 2 (D-SIN2), providing the information of the serving cell itself to the MS, is not found in the clause 18. This PDU and its elements, defined as shown, are identical to the definitions of the PDU D-MLE-SYNC in the V+D part only with the Late entry information removed though.					
	Information Element	Length	Type	C/O/M	
	MCC	10	1	M	
	MNC	14	1	M	
	Neighbour Cell Broadcast	2	1	M	
	Cell Service Level	2	1	M	
Validation decision					
N/A					
NOTE: This PDU shall not contain an “O” bit and shall be 28 bits in length.					

No.	MLE 3	**Reference**	18.3.4.7.3/4/5 - ETS 300 393-2	**Category**	Normative
Item					
There should be no MLE PDUs exchange involved in restoring a CONP connection. As for the SCLNP entity, the CONP entity harnesses the packet-switching mechanism in the lower layers that it may re-establish data communications by re-sending data packets which have not yet been successfully transferred to the RPDI. The two PDUs ‘D-RESTORE-ACK’ and ‘U-RESTORE’, as defined in the clause of 18.4.1.4.4 and 18.4.1.4.7, should be regarded as irrelevant to the procedure of CONP connection restoration.					
Validation decision					
The PDUs ‘D-RESTORE-ACK’, ‘D-RESTORE-FAIL’ and ‘U-RESTORE’ in the clause 18.4.1.4.4/5/7 respectively should be removed. Also, those paragraphs, wrongly relating the procedure of CONP connection restoration to the use of PDUs ‘D-RESTORE-ACK’ and ‘U-RESTORE’, should also be deleted. Similarly, the three PDUs now on the table 115 in 18.5.20 should be marked as reserved.					
NOTE:					

No.	MLE 4	**Reference**	18.4.1.4.6 - ETS 300 393-2	**Category**	Normative
Item					
As the type-1 cell reselection is not supported by the PDO part, the IE ‘SDU’ in the PDU ‘U-PREPARE’ should not carry any MM PDU and becomes obsolete.					
Validation decision					
This IE should be renamed as ‘Reserved’.					
NOTE:					

No.	MLE 5	**Reference**	18.4.1.4.2 - ETS 300 393-2	**Category**	Normative
Item					
As the type-1 cell reselection is not supported by the PDO part, the IE 'SDU' in the PDU 'D-New-Cell' should not carry any MM PDU and becomes obsolete.					
Validation decision					
This IE should be renamed as 'Reserved'.					
NOTE:					

No.	MLE 6	**Reference**	18.5.8 - ETS 300 393-2	**Category**	Normative
Item					
The IE 'late entry information' is associated to the CMCE circuit-mode call function, which is not supported by the PDO.					
Validation decision					
This IE should be removed from the ETS 393-2.					
NOTE:					

No.	MLE 7	**Reference**	18.5.2 - ETS 300 393-2	**Category**	Normative
Item					
The Minimum mode service is not supported by the PDO L2 entity.					
Validation decision					
The IE 'Minimum mode service' should be removed from the ETS 393-2.					
NOTE:					

No.	MLE 8	**Reference**	18.3.5.3.1 - ETS 300 393-2	**Category**	Informative
Item					
No advanced link service may be harnessed by the MLE, as such service is not supported by the Layer 2. Hence, the TL-CONNECT, -DISCONNECT and -RELEASE service primitives become obsolete.					
Validation decision					
Regardless of the PDU size, all MLE PDUs will be sent with the TL -DATA request primitive only.					
NOTE:					

No.	MLE 9	**Reference**	18.2.2. - ETS 300 393-2	**Category**	Informative
Item					
Both service primitives MLE_BUSY request and MLE_IDLE request are found in the reference clause, but the clause 16 & 17 of MM entity never mention these two services. They are used in the V+D part for locking or freeing up a MLE from changing the channel, when a group call is active. As CMCE is not supported in the PDO part, these two service primitives therefore now become obsolete.					
Validation decision					
N/A					
NOTE:					

No.	MLE 10	**Reference**	17.3.1.2, 17.3.2.4 and 17.3.3.5 - ETS 300 393-2	**Category**	Informative
Item					
Upon receipt of a MLE-UNITDATA request, the MLE entity will send a first MLE-REPORT indication back to the upper L3 service user with an endpoint identifier (with transfer result set to “endpoint id”). This endpoint identifier is generated by the MLE and retained locally, and is also passed to the layer 2 for the corresponding protocol transaction by sending TL-DATA Request. Upon the receipt of the TL-DATA confirm from the L2, the second MLE-REPORT indication will be sent to the upper L3 user with a transfer result. The lifetime of an endpoint identifier is only valid, until the receipt of a second TL-DATA Confirm or a MLE-CANCEL Request, with a matching endpoint identifier. The endpoint identifier is essential for the L3 protocols for handling one or more transaction(s) at any time. This is done by matching the endpoint identifier of a response (i.e. TL-DATA confirm) to a transaction-in-progress.					
Validation decision					
This change has been implemented in the validation model.					
NOTE:					

No.	MLE 11	**Reference**	17.3.1.2, 17.3.2.4 and 17.3.3.5 - ETS 300 393-2	**Category**	Informative
Item					
The LMM/CO/SCL-SAP service primitives are not well defined.					
Validation decision					
It is suggested to adopt those definitions from the V+D part with following modifications made for the PDO part: 1) For LMM-SAP, MLE-BUSY/IDLE request should be removed. 2) For LMM-SAP, Attached/Deleted GSSIs may be renamed as Added/Deleted GSSIs in the MLE-IDENTITIES request. 3) For LMM-SAP, MLE-PREPARE request should be removed. 4) For all SAPs, the parameters “sterling permission” and “Stealing repeats flag” should be removed from the MLE-UNITDATA Request. 5) For all SAPs, the parameter “Handle” should be replaced by “Endpoint ID” in the MLE-REPORT indication. 6) For the LMM-SAP, the parameter “Transfer result” should now be defined as any of following values: ‘request cancelled’, ‘success’, ‘fail’ and ‘endpoint id’. 7) For the LCO/SCL-SAP, “Transfer result” should now be defined as any of following values: ‘request cancelled’, ‘success’ and ‘fail’. 8) For the LCO/SCL-SAP, the parameter ‘QoS’ should be removed from the MLE-UNITDATA request.					
NOTE:					

No.	MLE 12	**Reference**	18.4.1.5 - ETS 300 393-2	**Category**	Editorial
Item					
The D-MLE-SYSINFO should be renamed as System Information 1 (D-SIN1).					
Validation decision					
N/A					
NOTE:					

No.	MLE 13	**Reference**	18.3.5.3.1 a)/c) - ETS 300 393-2	**Category**	Editorial
Item					
The layer 2 “Acknowledged Response Service” in the V+D part, established by sending a service primitive TLA-Data Confirm/response with a replying Layer-3 PDU, is not supported by the PDO part. Instead, the PDO part only allows the ordinary layer 2 “acknowledged request service” and “unacknowledged service”. In other words, a replying layer-3 PDU is conveyed by the TLA-Data Request only.					
Validation decision					
All paragraph corresponding to the L2 acknowledged response service should be removed.					
NOTE:					

6.5 Layer 2 entity

6.5.1 Validation purposes

The validation purposes are concerned with downlink and uplink data transfer via TLA-SAP. Messages sent via TLB-SAP and TLC-SAP are outside the scope of this validation.

The SDL model used for layer 2 validation includes a layer 1 which can simulate the loss of layer 2 PDUs (and data blocks within PDUs). The manner in which layer 2 handles any layer 1 failure scenario can thus be examined. For the validation purposes marked 'SS' (Success Scenario), the layer 3 SDU was successfully transferred between peer entities. For the validation purposes marked 'FS' (Failure Scenario), the layer 3 SDU was not successfully transferred between peer entities. In the latter case, layer 1 was configured to cause the transfer failure in order to verify that the layer 2 SDL model responds correctly.

6.5.1.1 Downlink - Acknowledged - Single SDU

1) SS - No bad data blocks;
2) SS - Bad data blocks which are corrected;
3) SS - Bad data blocks which are left uncorrected;
4) FS - MS does not receive DD1;
5) FS - BS does not receive UR in response to DD1;
6) FS - MS does not receive first DD2;
7) FS - BS does not receive UR in response to first DD2;
8) FS - BS does not receive UR in response to final DD2;
9) FS - SDU transfer cancelled by layer 3.

6.5.1.2 Downlink - Acknowledged - Chained SDU

1) SS - No bad data blocks;
2) FS - MS does not receive first DD2 in chained SDU;
3) FS - BS does not receive UR in response to first DD2 in chained SDU;
4) FS - MS does not receive second DD2 in chained SDU.

6.5.1.3 Downlink - Unacknowledged - Single SDU

1) SS - No bad data blocks;
2) FS - MS does not receive final DD2.

6.5.1.4 Uplink - Acknowledged - Single SDU

1) SS - No bad data blocks;
2) SS - Bad data blocks which are corrected;
3) SS - Bad data blocks which are left uncorrected;
3) FS - BS does not receive UD1;
4) FS - MS does not receive DR1 in response to UD1;
5) FS - BS does not receive first UD2;
6) FS - MS does not receive DR2 in response to first UD2;
7) FS - BS does not receive intermediate UD2;
8) FS - MS does not receive final DR2;
9) FS - BS does not receive final UD2;
10) FS - SDU transfer cancelled by layer 3.

6.5.1.5 Uplink - Acknowledged - Chained SDU

1) SS - No bad data blocks;
2) FS - BS does not receive first UD2 in chained SDU;
3) FS - MS does not receive first DR2 for chained SDU;
4) FS - BS does not receive second UD2 in chained SDU.

6.5.2 Options, constants and parameters

Options, constants and parameters used in the validation in Layer 2 are given in the Table 4. The values used simplify the validation process without resulting in loss of generality.

Table 4: Options, constant and parameter values used in the validation of Layer 2

Name	Values used	Specification	Remarks
FRAMES_PER_MULTIFRAME	8	150	
MAX_DATA_BLOCKS_PER_PDU	3	40	
MAX_DATA_BLOCKS_PER_SEGMENT	7	40	
MAX_QUEUED_SDUS	3	NA	
MAX_TRANSMIT_RETRIES	2	3	
MAX_WINDOWS_BETWEEN_ACCESS	4	15	
T.255	72 frames	750 frames	
T.256	24 frames	750 frames	

6.5.3 Validation results

The validation has shown that the layer 2 protocol specification is functional. However, a number of changes are proposed to make the protocol more efficient and expandable.

No.	L2 1	**Reference**	19.1.2.1	**Category**	Normative
Item					
The Layer 2 point-to-point unacknowledged service described in the specification is described as being supported in both the downlink and uplink directions. However, the uplink version of this protocol is very different from the downlink version of this protocol. In the downlink version, the BS sends a series of DD2 PDUs without ever receiving an acknowledgement from the MS. In the uplink version, the BS must allocate uplink bandwidth for each UD2 PDU prior to transmission by the MS; in effect, the BS is acknowledging receipt of each UD2 PDU. Since the most common use of unacknowledged service is in association with point-to-multipoint communication (where it is required), it is proposed that the unacknowledged service described in the specification be made downlink only.					
Validation decision					
Unacknowledged service will be supported in the downlink direction only.					

No.	L2 2	**Reference**	22.5.3.1,22.6.2	**Category**	Normative
Item					
The acknowledged service can be generalized in both the downlink and uplink directions so that the sender can complete the transfer of an SDU with one or more bad blocks left uncorrected. The number of bad blocks left uncorrected is entirely up to the sender. If the sender decides to leave all bad blocks uncorrected in an uplink transfer, then the proposed generalized acknowledged service is being used in a manner identical to the old uplink unacknowledged service.					
Validation decision					
The model supports generalized acknowledged service.					

No.	L2 3	**Reference**	20.3.8,20.3.2	**Category**	Normative
Item					
The current specification allows the BS and MS to transfer data blocks in DD1 and UD1 PDUs. DD1 PDUs are sent on the ACCH logical channel and UD1 PDUs are sent on the RACH logical channel. It is proposed that the DD1 and UD1 PDUs be used ONLY to establish a data transfer link on dedicated DTCH and UTCH logical channels, for the following reasons: a. it is much more difficult for a BS to predict access requirements for a given population of MS if any MS can fill an entire access window with a data transfer (UD1 + data blocks) PDU.					

b. a greedy MS can prevent all other MS with the same default priority level from doing uplink. c. the DR3 PDU can be eliminated d. the protocol is greatly simplified
Validation decision
The model does not support the use of DD1 and UD1 PDUs for transferring data.

No.	L2 4	**Reference**	20.3.8,20.3.2	**Category**	Normative
Item					
The UR PDU should be split into UR1 and UR2 PDUs. There are fields in the current UR PDU which have no meaning during downlink establishment. Also, using UR1 for establishment and UR2 for data transfer makes the downlink protocol parallel to the uplink protocol.					
Validation decision					
The model supports UR1 and UR2 PDUs.					

No.	L2 5	**Reference**	20.3.7,20.4.2	**Category**	Normative
Item					
The current specification employs access windows (random and dedicated) defined by symbol times. It is recommended that access windows be defined by block ranges instead. The scheduling algorithms in the BS do not benefit from the much higher resolution provided by symbol-level access window definition, and implementation in both the BS and MS is more difficult.					
Validation decision					
The model employs random and dedicated access windows defined by block ranges.					

No.	L2 6	**Reference**	21.3.6	**Category**	Normative
Item					
It is recommended that the permitted number of unacknowledged MAC PDUs outstanding (the “MAC window size”) be fixed at 1, because MAC window sizes greater than 1 provide no discernible benefit and much greater complexity.					
Validation decision					
The model only supports a MAC window size of 1.					

No.	L2 7	**Reference**	20.3.9,20.3.5	**Category**	Normative
Item					
It is recommended that support for intra-SDU dedicated channel hopping be removed from the specification. This capability provides the BS with greater flexibility when managing congestion, but the cost is much greater protocol complexity. This capability can be re-introduced in a future revision of the specification if it is determined that BS scheduling algorithms without intra-SDU dedicated channel hopping cannot successfully manage congestion.					
Validation decision					
The model does not implement intra-SDU dedicated channel hopping.					

No.	L2 8	**Reference**	22.3.4	**Category**	Normative
Item					
It is recommended that the specification be altered so that the ACCH and MCCH are on the same physical channel. The MS then continually monitors the SIN1, SIN2, and AA PDUs. This simplifies the protocol for both the BS and MS, and greatly reduces the maximum uplink establishment latency.					
Validation decision					
MCCH and ACCH on different physical channels is not supported by the model.					

No.	L2 9	**Reference**	20.3.5	**Category**	Normative
Item					
The current specification requires the BS assign a unique uplink label (UL-Label) for the PDU exchanges associated with the transfer of each segment of an SDU (these PDU exchanges are called a transaction in the specification). There is no apparent reason why the same UL-Label cannot be used for all PDU exchanges associated with an SDU, regardless of the segment in which they take place. This makes the DR2 PDU one block long instead of one or two blocks long.					
Validation decision					
A single UL-Label is assigned for all segment transactions of an SDU.					

No.	L2 10	**Reference**	22.5.3.1	**Category**	Normative
Item					
The current specification has no mechanism for allowing the BS to increase the latest MS uplink reservation request if bad blocks were received in the previous UD2 PDU from the MS. This results in lower uplink SDU transfer efficiency. If the BS can be placed in a mode where it assumes that the MS will want to retransmit any bad blocks, it can automatically increase the MS uplink reservation request for any bad blocks received.					
Validation decision					
The BS will be able to automatically increase the MS uplink reservation request for any bad blocks received if requested by the MS during uplink establishment.					

No.	L2 11	**Reference**	22.5.3,22.6.2	**Category**	Normative
Item					
It is recommended that the protocol be extended to support SDU chaining -- the transfer of multiple consecutive SDUs on dedicated traffic channels without intervening traffic channel establishments. Traffic composed of a stream of relatively small SDUs is handled much more efficiently with SDU chaining.					
Validation decision					
SDU chaining has been implemented in the model.					

No.	L2 12	**Reference**	20.3.11,22.5.2,22.6.3.2	**Category**	Normative
Item					
It is recommended that WU-label and RA-label assignment to one or more MS using the AP PDU be eliminated. There is no apparent reason for targeting certain WU PDUs for certain subsets of MS, and RA-labels are a redundant method for controlling MS random access to RACH access windows. It is recommended that MS random access be governed entirely by SDU access priority. A MS receives a default SDU priority level upon registering with a BS. It effectively joins a group composed of all other MS with the same default SDU priority level (and thus the same random access privileges). Therefore, there is no need for RA-label assignment functionality, which also creates groups of MS with similar random access privileges.					
Validation decision					
WU-label and RA-label assignment are not implemented in the SDL model, and the AP PDU has been eliminated.					

No.	L2 13	**Reference**	20.3.8,20.3.2	**Category**	Normative
Item					
A field has been added to the DD1 and UD1 PDUs indicating how many times establishment has been attempted for the current SDU. This provides the BS with an indication of congestion and radio channel quality for uplink (UD1), and provides the MS with an indication of radio channel quality for downlink (DD1).					
Validation decision					
This feature has been added to the model.					

No.	L2 14	**Reference**	19.2.2.1	**Category**	Normative
Item					
The BS should be able to specify the DD2 and DR2 timeout values dynamically during establishment. This allows the BS to lengthen and shorten the downlink timeout values depending on system load.					
Validation decision					
The model supports dynamic DD2 and DR2 timeout values.					

No.	L2 15	**Reference**	19.2.2.1	**Category**	Informative
Item					
It is recommended that the UnitDataRequest, UnitDataIndication, and UnitDataConfirm L3/L2 primitives be eliminated, and a Protocol Selector field be added to the DataRequest primitive indicating how layer 2 should transfer the SDU. This permits new protocols to be added to layer 2 without requiring the addition of three new primitives for each new protocol.					
Validation decision					
The three UnitData L3/L2 primitives are no longer used by the model, and a Protocol Selector field has been added to the DataRequest primitive.					

7 Protocol stack validation

7.1 Validation purposes

The selection of the stack validation purposes is done using the core functionality of the whole protocol stack. The idea is not to re-validate all the features in the individual protocols, but to ensure the inter-layer communication.

7.2 Options, constants and parameters

The stack validation is performed using the same option settings, timer values and constant values as for each individual protocol as described in the previous clauses.

7.3 Validation results

The validation results for the protocol stack validation are described among the ones for the individual protocol validation in the corresponding sub-clauses.

8 Validation result summary

The number of validation results found in each of the individual protocols and the protocol stack validation is shown in Table 5.

Table 5: Number of validation results

Entity	Normative	Informative	Editorial	Total
CONP	0	10	0	10
MM	14	5	12	31
SCLNP	3	10	16	29
MLE	7	4	2	13
Layer 2	14	1	0	15
Total	38	30	30	98

Annex A: Validation files on floppy disk

The validation cases are provided on the diskette attached to this report. The validation case files are stored in MSC textual format (.mpr extension) and PostScript encapsulated format (.eps extension).

The protocol files are compressed into file *protocol.zip*. Uncompressing *protocol.zip* results in the following directory structure:

/protocol

- /conp: CONP validation cases
- /sclnp: SCLNP validation cases
- /mm: MM validation cases
- /mle: MLE validation cases
- /layer2: Layer 2 validation cases

The MSCs do not show all signals that can occur during the execution of the validation cases. All signal parameters given in MSCs are informal and signals may or may not contain parameters. Usually, only parameters directly affecting to the protocol behaviour are presented. If parameters are present in a signal, they normally present only a subset of all valid parameters for that signal. This partial specification of parameters aids readability, because some of the signal have complex parameters.

History

Document history	
June 1998	First Edition

ISBN 2-7437-2192-8
Dépôt légal : Juin 1998