



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Supplement 1

(Series Q.780)

(10/95)

**SPECIFICATIONS OF SIGNALLING
SYSTEM No. 7**

**SIGNALLING SYSTEM No. 7 TESTING
AND PLANNING TOOLS**

**Supplement 1 to
ITU-T Series Q.780 Recommendations**

(Previously "CCITT Recommendation")

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Supplement 1 to Series Q.780 Recommendations was revised by ITU-T Study Group 11 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 17th of October 1995.



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Supplement No. 1

Signalling System No. 7 testing and planning tools

1 General

This supplement provides information about SS No. 7 testing and planning tools that are in use by some organizations. The IUT-T does not endorse these tools and has not verified the claims made by contributors of the information. It should be used as a guide to the type of tools that are used.

Each tool is described briefly and a contact address is provided for further information. The TSB cannot provide further information.

The SS No. 7 testing tools are SS No. 7 protocol testing tools and SS No. 7 load generating tools. The protocol testing tools are typically used by staff that are testing that the various SS No. 7 protocols operate correctly i.e. protocol verification. They can emulate one end of an SS No. 7 link or they can monitor the messages that pass in both directions on a signalling link between two working SS No. 7 equipment. The SS No. 7 load generating tools are typically used to test that the SS No. 7 equipment, or the exchange that uses it, operates correctly under various signalling load conditions.

The SS No. 7 planning tools are used to plan and verify the SS No. 7 signalling network. These tools are typically used by network planners to create a network plan or to generate and prove Level 3 routing tables. They may also be used by operational staff to verify the correctness of the implemented signalling network.

1.1 Explanation of terms

Monitoring

Where the test equipment is non-intrusively connected to a transmission line and “listens” to the communication on that line. Two monitors are usually required to monitor both directions of a communication channel. The monitored data can be displayed, decoded and stored.

Emulation

Where the test equipment replaces one of the signalling entities and operates as if it was a real signalling entity. Some layers may be emulated while the layer above may be operated in simulate mode (see below).

Simulation

Where the test equipment replaces one of the signalling entities and operates under the control of test sequences which can produce correct and incorrect protocol actions. Simulation is supported by tools to create messages and formulate state machines.

Conformance testing

Conformance testing is the rigorous testing of a protocol using the simulation mode of operation. Suites of standard tests are created which enable an implementation of a protocol to be compared against the specified protocol.

2 SS No. 7 testing tools

The following SS No. 7 testing tools are described:

- Alcatel performance and load test system A8610;
- Alcatel protocol conformance test system A8650;
- British Telecom (BT) NTS M300;
- Hewlett Packard HP 18273A;
- Hewlett Packard HP 37900D;
- Idacom PT300 and PT500;

- Siemens ISDN Test Simulator (ITS);
- Siemens K1103;
- Siemens K1195 and K1197;
- Tekelec TE 767.

2.1 Alcatel A8610

The test system Alcatel 8610 is designed to support network operators, switching equipment manufacturers, R&D departments as well as laboratories for performance and load testing of IUT-T, ETSI, ANSI and other international and national SS No. 7 protocols. The modularity of the Alcatel 8610 test system allows to equip the test unit with other interfaces such as:

- 2/4 - wire analogue subscriber interface (for complex call handling);
- CAS (all kinds of line - and register signalling);
- BRA;
- PRA;
- V 5.1;
- CCS (MTP, SCCP, TUP, ISUP, TCAP, INAP, MAP, BSSAP, BSSMAP, DTAP and national variants),

for PCM 30 and PCM 24 channel systems. Interworking between above mentioned interfaces in terms of B-channel test and other traffic simulators is possible.

The A8610 system architecture allows multi-link and multi-level testing especially for all kinds of GSM implementations. The system consists of a SPARC¹⁾ IPX workstation and an open number of Test Units (TU) interconnected via a local area network (thinwire Ethernet IEEE 802.3, 10 base 2). Internet enables the user to set up the desired connection between the controlling Workstation and the test units. The user interface is the OSF/Motif¹⁾. It has achieved acceptance as the “de facto” industry-standard user environment. OSF/Motif¹⁾ is a graphical user interface offering user-oriented PC-style behaviour and screen appearance for applications running on any system which can support X11R5¹⁾.

The Alcatel 8610 has been developed especially with a view meeting the requirements of the advanced intelligent Network architecture in the area of both mobile communication and PSTNs. As far as hardware is concerned, a subrack can be equipped with a certain number of different modules providing access to either 1.8 or 31 (24) signalling channels (HDLC controller) per link (2.048 Mbit/s or 1.544 Mbit/s). The flexibility of the architecture is not only characterized by the possibility to freely configure a subrack with the modules mentioned above according to specific user's requirements, but also by the Multibus II, which secures the communication between the different modules mentioned above.

This new test system allows all existing user and application part protocols to be implemented. The scenarios (test suites) are developed by Alcatel STR considering customer specifications concerning test requirements, exchange protocols and other aspects. The scenario editor, being part of the basic application software, allows the user to modify a test scenario up to the last bit. Because of the open structure of this software, most complex or proprietary tests can be developed and executed by the user himself.

Detailed statistics during simulation on the equipped interfaces including unexpected messages, wrong message sequencing, etc. are logged and time stamped. The monitor function screens the Level 3 and Level 4 condition on line. The output of the collected result files for post processing is also possible (graphic and text).

Examples of load test performance of the Alcatel 8610 on one 2.048 Mbit/s interface with one signalling channel and 30 speech channels:

ISUP:	70 000 call attempts/h	(40% load of the signalling channel)
GSM:	Location update	16 000 per interface, per hour
	MOC and MTC	11 000 per interface, per hour

¹⁾ SPARC, OSF/Motif and X11R5 are registered trade marks.

One Alcatel 8610 can for example be equipped with four (4) of the above interfaces which leads to a possible total amount of ISUP call attempts of 280 000/h distributed on four (4) signalling channels per test unit.

2.2 Alcatel A8650

On the basis of Recommendation X.290 (ISO 9646) Alcatel STR designed the protocol conformance test system Alcatel 8650. The aim of the development was to provide a convenient aid firstly for the rational specification and management of Test Cases (TCs) in a defined notation and secondly to automatically run series of TCs (e.g. a Test Suite). This yields the following main functions:

- TC specification by interactive dialogue with the user (TTCN Editor);
- Syntax and semantic check of a Test Suite (TS);
- Conversion of the TCs specified within the Test System or externally;
- Editing of implementation specific data or parameters (PICS/PIXIT);
- Selection of TCs to be executed;
- Automatic execution of TCs by controlled simulators at the appropriate interfaces of the test object (multi-link control);
- Generation and of test reports including test results and trace files;
- Management and “maintenance” of TCs.

2.2.1 Applications

As first application A8650 was implemented to for testing GSM infrastructure (BSS, SSS and overall). In this typical application it features multi-link control of different interface types (e.g. C/D and A interface). As IUT-T standardized interfaces are used in GSM the TS can be applied for other infrastructure testing too.

The following executable TS are available:

- CCITT Q.711-Q.716 SCCP (*Blue Book*);
- CCITT Q.761-Q.764 ISUP (*Blue Book*);
- CCITT Q.767 ISUP;
- CCITT Q.771-Q.775 TCAP (*Blue Book*);
- GSM: MAP, LapDm, RR and SMS.

2.3 British Telecom (BT) NTS M300

The British Telecommunication plc Network Testing System M300 has been developed specifically for conformance and performance testing of IUT-T SS No. 7 implementations.

The system architecture of the M300 facilitates its use for multi-link and multi-level testing of SS No. 7 implementations in a unified environment. It can operate in either emulation mode for development, acceptance and regression testing or in monitor mode for surveillance. In both modes, the M300 can be under either local or remote control.

A Personal Computer (PC) provides the man-machine interface to the M300. The M300 is implemented as a PC or a rack based system, supporting up to two or 16 links, respectively. There are a number of simulate and monitor interface options. The PC and the M300 are inter-connected by means of a Local Area Network.

The proprietary testing language allows testing of the SS No. 7 message based protocol. This includes the ability to:

- SEND and WAIT for named messages;
- manipulate field contents;
- check that fields in incoming messages have expected values.

The language is particularly suited to expressing Message Sequence Chart message inter-changes. As an option, a means of entering and executing test scenarios expressed in Tree and Tabular Combined Notation (TTCN) form is available. At certain levels, automatic functionality is provided where necessary to allow the testing of the higher levels in the protocol stack once a lower level has been satisfactorily tested. A thorough means of exercising Level 3 is provided by means of background test traffic message generators and receivers to allow automatic determination of:

- message loss;
- mis-sequencing or duplication under changeover and changeback conditions.

Test suites are presently available for the M300 to determine conformity to the following specifications:

- CCITT MTP and TUP (based on Q.781 to Q.783 test specifications);
- CCITT ISUP basic call and supplementary services (based on Q.784 and Q.785 test specifications).

The detail with which messages sent and received are displayed can be modified. This can be from mnemonic and routing display, optionally appended with a hex dump and/or field decode, to not being displayed at all. All messages are timestamped accurate to 1 ms. Output can be directed to the PC disk or printer as well as being displayed on the screen.

A tool is provided that enables users to define their own message set. A number of generic message sets are available for the testing of: MTP, TUP and ISUP. From these, national variants can readily be implemented, for example the British NUP.

2.4 Hewlett Packard HP 18273A

This is a portable, general purpose protocol analyser that supports ISDN, SS No. 7, X.25 and SNA protocols. It apparently supports monitoring only.

The HP 18273A is intended to be used by network providers for installation and maintenance testing. It has the following SS No. 7 capabilities:

- Level 2 (Q.703), Level 3 (Q.704) and Level 4 message fields are decoded into mnemonics.
- Decodes the ISUP, SCCP, TUP and DUP messages and parameters. Additional user parts can be defined as well.
- The hex codes and mnemonics for user parts and message types can be user-defined.
- Selected fields following the message type field, such as called and calling numbers, are decoded.
- Customized data displays in one or two columns can be created and saved to address user specific needs.
- Filtering of LSSUs and FISUs is provided so that data capture buffer efficiency can be maximized.
- SS No. 7 data can be analysed utilizing all available physical interfaces for the HP 4952A.

2.5 Hewlett Packard HP 37900D

The HP 37900D Signalling Test Set is designed for use in the maintenance of SS No. 7 links, but provides an emulation software option which enables the tester to be also used in design verification or installation. The HP 37900D can monitor four bi-directional SS No. 7 links or emulate eight links. It also supports ISDN (Recommendations Q.921/Q.931) for cross-switch testing. The tester can be “personalized” so that it is tailored for customer test requirements.

2.5.1 Monitoring capabilities

Monitoring capabilities consist of real-time analysis while logging and post-logging analysis. All data or selected data can be logged from all links. "Logging conditions" for controlling data capture include real-time message-based start and stop triggers and filters. Additionally, all SS No. 7 messages associated with a specified (or partially specified) telephone number can be collected. Real-time analysis while logging consists of link quality measures, link activity indicators and customized decodes (up to eight split screens, statistics or histogram displays). Messages in the logged data can be quickly found using search facilities or can be viewed selectively by instructing the tester to display or suppress messages. Level 2 and all higher level messages may be decoded to text descriptions of the specification document. Alternative decodes can be utilized during decoding. Statistical data for the logged data is available for Level 2 and Level 3 characteristics.

Numerous SS No. 7 user parts (MTP, ISUP, TUP, SCCP, TCAP, GSM, NMT MUP and HUP, etc.) and national variants are supported as standard (Bellcore, ANSI, 1TR7, BTNR166, Finland, etc.)

2.5.2 Emulation capabilities

The HP 37900D can, optionally, emulate a maximum of eight links simultaneously. Level 2, Level 3 or above tests are possible. Automatic Level 2 is also available. In test sequences, messages are sent and received on any or all of the links being emulated. Messages are created in several ways and are stored separately from the test sequences. Messages can be built using the menu driven emulation software or can be extracted from the monitor capture buffer. Once created, messages are held in catalogues and can be stored on disk for future emulations. Octets within messages, being used for comparison against received messages, can be masked. The OPC/DPC of received messages can be swapped, parts of received messages can be extracted and held as variables, then restored as part of an outgoing message. All activity on the links including unexpected messages, during emulation are stored in the test log and timestamped. Tests can be run manually or automatically.

2.5.3 Remote Control

The HP 37900D can be controlled remotely over an RS-232C communication link by any terminal which supports the HP mode escape sequences and control codes, or any device that can run an HP terminal emulator or any NSI compatible terminal. It provides two-way communication between the local terminal and the remote test set.

2.6 Idacom PT300/500

The Idacom PT300 is a low end multi-port, multi-protocol tester. The PT 500 is a high end multi-port, multi-protocol tester. Both testers support access interfaces for PRA (T1 and E1), WAN, DS0 and BRA.

2.6.1 Test Package

- a) SS No. 7 Monitor package.
- b) SS No. 7 Emulation package which includes:
 - complete MTP Level 2;
 - partial MTP Level 3;
 - partial SCCP (Class 0 and 1);
 - TCAP Simulation;
 - ISUP Simulation;
 - TUP Simulation.

All emulations can be either manual or automatic.

- c) Decode and Encode for:
 - CCITT *Blue Book*, all functional parts;
 - ANSI (1988, 1991) all functional parts;
 - Telecom Canada (1988) all functional parts including enhanced 1-800 services, BNS and ACCS;
 - Bellcore (1987 – present) all functional parts including 1-800 services, CLASS features, LIDB and Billing Validation;
 - ITR7 (1987) all functional parts;
 - Hong Kong Telecom (1988) all functional parts;
 - Singapore Telecom (1991) all functional parts.
- d) Independent sets of filters for display, RAM capture, data recording and test manager. Filters are set up via menus and specified using mnemonics of the message type, parameter name, parameter contents and routing labels.
- e) Four triggers with build-in or user definable actions. Triggers are set up in the same way as filters.
- f) Data capture to RAM or disk.
- g) Live and post analysis.
- h) Traffic generation capability.
- i) Report generation.

2.6.2 Conformance Test System

- a) The SS No. 7 Conformance Test System is implemented according to ISO-9646 standard.
- b) Each executable test suite has its own PICS and PIXIT set-up. Entries in the PICS and PIXIT set-up are user configurable.
- c) Executable test suites include:
 - CCITT Q.781 MTP Level 2 (*Blue Book*);
 - CCITT Q.782 MTP Level 3 (*Blue Book*);
 - Bellcore MTP (TR-TAP-001004);
 - NOF (Network Operators Forum) MTP Network Compatibility tests (1990).
- d) Executable test suites planned for development include:
 - CCITT Q.784 ISUP (1992);
 - CCITT Q.785 ISUP Supplementary Services (1992);
 - Bellcore ISUP (TR-TAP-001004);
 - Bellcore SCCP;
 - NOF ISUP;
 - NOF SCCP.

2.7 Siemens ISDN Test Simulator

The ISDN Test Simulator (ITS) is a test tool suitable for function and load testing and network simulation for SS No. 7 and other protocols. It consists of a Personal Computer (PC) controlling up to 16 Communication Groups (CGs).

Each CG can support up to eight signalling links, therefore one ITS can control up to 128 signalling links. A CG can also support ISDN Basic Accesses, ISDN Primary Rate Accesses or Analogue Subscriber interfaces. One CG can support up to four MTPs (Level 3s) and 32 Users. MTPs and Users are implemented using test scenarios. Test scenarios operate in a CG independently of the PC.

On the PC is displayed the current traffic rate (in BHCA), the failure rate and other test information. Output of data files for post processing is also possible.

2.7.1 ISDN Traffic Simulator for Message Transfer Part (MTP)

The ITS:CCS7 operates as a partner of the System Under Test (SUT), by simulating one or more SPs. During operation, a monitor function can display and record selectively all traffic between the Level 2 and Level 3 interface in the ITS. This output appears partially decoded in symbolic form or as a hexadecimal dump.

The ITS:CCS7 is suitable for Level 3 and Level 4 tests. The Level 2 cannot be modified. Level 3 and Level 4 tests are carried out using test scenarios written in the high-level language C. The operator has complete freedom in the development of any test scenario. The following scenarios are already available:

- Signalling Link Management (processes Level 2 primitives).
- Testing and Maintenance (processes Link Test messages).
- Signalling Network Management (processes Signalling Network Management messages).
- Signalling Message Handler (distributes messages/primitives from Level 2 to the other scenarios).
- Source/Sink (sends and receives MSUs).
- Reflector (swaps DPC and OPC in received MSUs and sends them in a transmitted MSU).
- Deflector (extended reflector which calculates the DPC from the OPC using a formula).

2.7.2 ISDN Traffic Simulator for User Part (ISUP)

The ITS:CCS7 generates a traffic load of up to 140 000 BHCA per CG or up to 2 240 000 BHCA total for a fully equipped ITS. Currently available scenarios (for sending and receiving sides) include:

- ISUP CCITT *Blue Book* Q.761-Q.764;
- ISUP FTZ 1TR7;
- TF FTZ 1TR7.

2.8 Siemens K1103

The K1103 Service Tester can monitor up to four SS No. 7 links simultaneously. It has the following features:

- measure load sharing over SPs/STPs or parallel links between SPs/STPs;
- count call attempts;
- pursue particular calls;
- based on IBM-AT compatible portable PC;
- fully menu operated, particularly suited to field and service applications.

It supports the same protocols as the K1197.

2.9 Siemens K1195

The K1195 Protocol Tester is a general protocol tester supporting many interfaces and protocols. In its SS No. 7 testing mode it is designed to perform the following tasks:

- monitor one SS No. 7 link;
- simulate one signalling source (SP/STP);
- emulate one signalling source (SP/STP).

It supports the same protocols as the K1197.

2.10 Siemens K1197

The K1197 Protocol Tester is a general protocol tester supporting many interfaces and protocols. In its SS No. 7 testing mode it is designed to perform the following tasks:

- monitor up to two SS No. 7 links simultaneously;
- simulate up to four signalling sources (SP/STP serving one SS No. 7 link each) simultaneously;
- emulate up to four signalling sources simultaneously;
- perform conformance testing according to Recommendations Q.780-Q.783 ;
- create statistics in the form of tables and bar graphs.

The protocol supported include:

- MTP 1984 *Red Book* and 1988 *Blue Book* Q.701-Q.704;
- TUP 1984 *Red Book* and 1988 *Blue Book* Q.723;
- TUP+ CEPT T/SPS-43-02, FTZ 1TR8, Part 3, 12/87;
- ISUP 1988 *Blue Book* Q.763, FTZ 1TR7, Part 5, 4/87;
- SCCP 1988 *Blue Book* Q.713;
- TF FTZ 1TR7, Part 3, 4/87;
- TCAP 1988 *Blue Book* Q.771 - Q.774, ETSI, ETS, 300-134;
- Many national variants, e.g. of MTP;
- GSM: MTP, MRP, DTAP, BSS-AP, A *bis*.

2.11 Tekelec TE767

The TE767 is a portable protocol analyser for testing SS No. 7 networks. It meets the needs of operating companies for installation and maintenance. It provides two link interfaces for monitoring a signalling link set.

Functions:

- simple language for the sophisticated triggering on both signalling links when on-line or off-line;
- adjustable monitoring of the physical layer, MTP, TUP, ISUP, etc. using clear mnemonics;
- filtering according to a User Part, a CPD, a type of message, a called number, a communication, etc.;
- statistics for on-line and off-line displayed in the form of tables and bar graphs for:
 - a) traffic distribution;
 - b) signalling link set load;
 - c) user-defined events distribution;
 - d) signal unit length distribution.

Flexibility:

Easy to update data bases describe the messages and codes for national protocols. The existing data bases include:

- MTP *Blue Book* – Finnish MUP and HUP
- TUP *Red Book* – German 1TR7
- TUP+ – UK NUP
- DSS1 *Blue Book* – UK DASS/DPNSS
- X.25 *Blue Book* – French SSUTR2
- etc.

Facilities:

- field trial oriented – portable and easy to use;
- integrated or remote printer;
- digital (2 Mbit/s) or analogue (V24, V35) interfaces.

Typical applications:

- trouble shooting diagnostics;
- Q.791 and Q.795 tests for MTP and TUP;
- load sharing measures;
- efficiency of calls;
- transit delay measurements;
- etc.

3 SS No. 7 Planning Tools

The following Planning Tools are described:

- Bellcore Integrated Network Planning System (INPLANS);
- Deutsche Bundespost TELEKOM SS No. 7 Planning Tools;
- Telecom Australia CCS Operations and Planning Support System (COPSS);
- Telecom Australia CCS7 Data Management System.

3.1 Bellcore Integrated Network Planning System (INPLANS)

The Integrated Network Planning System (INPLANS) is being implemented to support Regional Bell Operating Company (RBOC) network planning and traffic engineering across different networking technologies. It is an integrated system which allows for the planning of many network functions in addition to the SS No. 7 network components of networks.

Some of its functions are:

- Integrated Network Monitoring (INM) which supports planning and engineering studies that monitor the ability of in-service and planned networks to meet service and utilization objectives. The purpose is to identify situations where corrective planning action is necessary and to give early warning of problem situations to allow corrective plans to be formulated before service problems result.
- Integrated Network Servicing (INS) which provides an integrated and interactive environment supporting planned servicing, demand servicing and customer driven servicing. It uses the INM to make necessary adjustments (e.g. adding signalling links) to absorb sudden changes in demand before service is affected.
- Integrated Capacity Extension (ICE) which provides a one to five year view of the network demands and requirements. It computes network element growth rates, generates future network demands, times and dimensions the installation of equipment and generates a one to five year servicing plan.
- Integrated Technology Planning (ITP) which provides cost effective backbone and network access design plans. These plans identify the placement and interconnection of network nodes as well as optimal homing arrangement plans for new customers. The ITP uses cash flow analysis to economically evaluate the alternative plans.

SS No. 7 Network Planning and traffic engineering is supported in Release 2 of INPLANS. It can:

- analyse performance aspects of planned SS No. 7 networks for comparison with objectives;
- dimension an SS No. 7 network for particular traffic types;
- dimension an SS No. 7 network;
- check an SS No. 7 network structure.

3.2 Deutsche Bundespost TELEKOM SS No. 7 Planning Tools

The Deutsche Bundespost TELEKOM has developed two SS No. 7 planning tools. One tool supports the creation of routing tables for each SS No. 7 Level 3 in the SS No. 7 network and the other is used to validate the routing in the whole national SS No. 7 network.

The planning tools make some assumptions about the SS No. 7 network which include:

- the local and trunk signalling is carried by the same SS No. 7 network;
- each trunk exchange acts as a combined SP/STP;
- each route set consists of up to four routes (one plus three back ups);
- hierarchical routing is used (prevents circular routing);
- circuit related signalling traffic uses associated signalling preferably;
- non-circuit related end-to-end ISUP traffic uses SCCP Class 2.

3.2.1 Creation and updating of Level 3 routing tables

The national SS No. 7 network is planned by 14 network planning regions. The work of the network planners is supported by a centralized data base. The data base includes all data about the national SS No. 7 network for the next four years and the national numbering plan for the signalling points. It also includes a tool (based on an IBM-PC) for the creation and updating of the Level 3 routing tables. These are created in an interactive manner by each planning region. The planners enter the primary and alternative routes. The tool performs a check against the given routing rules and informs the user of possible alternative but not yet chosen routes.

This tool is also used for updating the national SS No. 7 numbering plan thus taking care of the implementation of additional signalling points.

3.2.2 Validation of routing tables

Validation of routing tables is performed by means of another tool in a centralized manner. Before the created or updated routing tables are implemented, they are all loaded into this tool. Then an evaluation of the routing tables concerning circular routing loops takes place.

This tool also creates routing table graphs for given signalling relations.

3.2.3 Further tools

The installed routing tables of the SPs are compared with the routing tables of the planned signalling networks. For this, the routing table of an SP is transferred by floppy disk to a central computer whenever the routing table is changed.

A tool which automatically creates the Level 3 routing tables is being developed but is not yet used. This tool will need the signalling points of the actual SS No. 7 network and the desired signalling relations. On the basis of the network structure, the given routing rules and the maximum number of signalling routes per route set, the tool will create circular routing free routing tables.

Another tool is being developed for simulating the signalling traffic distribution in the national SS No. 7 network.

3.3 Telecom Australia CCS Operations and Planning Support System (COPSS)

The COPSS is a PC-based computer system which assists in the planning, design and operation of an SS No. 7 network. It is menu driven, is easy to use and is generally applicable to any SS No. 7 network topology. In brief, it provides the following features:

- allows a model of the network to be loaded (e.g. transmission network topology);
- optimizes the topology of the network with free or paired allocation of SPs to STPs (criteria priorities are settable);
- calculates the load on network elements;
- generates routing tables for network nodes;
- checks routing tables for circular routing and other faults;
- allows automatic or manual failure tests;

- calculates the availability, MTTF, MTTR of all signalling relationships;
- allows all data to be loaded from, or unloaded to, unformatted text files;
- provides a comprehensive range of reports.

3.4 Telecom Australia CCS7 Data Management System

The CCS7 Data Management System is an IBM PC-based software package which is used to manage the actual SS No. 7 routing tables in the exchanges. It provides the following features:

- ability to read from and write to actual exchange SS No. 7 routing tables (in Ericsson AXE 10 exchanges – easily modifiable for other exchanges);
- ability to compare actual and planned SS No. 7 network routing parameters;
- provides a data base of the whole SS No. 7 network routing data;
- provides a pictorial representation of routing possibilities for any signalling relationships;
- detects and automatically corrects circular routing.

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(IDACOM is now a subsidiary of Hewlett Packard who act as agents as well.)

Siemens

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