BT ISDN30 Simulator

User's Guide V2
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ISDN30 Simulator

ISDN30 Simulator Package
Your ISDN30 Simulator Primary Rate tester package contains the following items:

- The ISDN30 Simulator
- Carry bag
- 12volt dc mains plug top battery charger
- 2 AA size NiMH 1.2volt batteries
- RJ45 to RJ45 network lead
- RJ45 plug to twin socket dual outlet adaptor
- 2 BNC T adaptors (M/F/F)
- 2 BNC plug to BNC plug leads
- 2 BNC plug to type 43 plug leads
- 9 way D RS232 COM port serial lead
- Headset
- ICode™ Auto Test software CD
- This User's Guide

ISDN30 Simulator Introduction
The ISDN30 Simulator is a low cost ISDN primary rate communications module which will operate as a loopbox in standalone mode or as a comprehensive ISDN 30e and DASS2 bearer quality and service provisioning tester when used in conjunction with the ICode Auto Test PC/laptop software. The unit requires no setup for loopbox mode.

When powered on the unit defaults to TE-S (PBX) simulation mode. Upon connection to an ISDN30e or DASS2 interface the ISDN30 Simulator will auto configure to the required protocol.

The unit can be used in NT-M (ET) simulation mode by pressing the NT-M (ET) Mode button. In NT-M (ET) Mode the unit will provide the master clock and send Network side messaging in response to call
setup and clear down messages from the PBX under test. This mode is useful to check basic PBX operation prior to connection to the ISDN30 bearer.

Monitor mode is selected by pressing the Monitor button. In Monitor mode the unit can log Layer 1, 2 and 3 protocol when bridged onto the NTE IN and OUT paths to the PBX, and will store up to 11,000 messages in the unit’s non-volatile store. When connected to ICode Auto Test protocol can be monitored in real time, or stored messages may be uploaded from the unit.

The unit is powered by 2 AA cells, which may be either NiMH rechargeable cells provided or alkaline cells. A 12Vdc battery charger is provided. Operating battery life is approximately 8 hours using 1200 mAh NiMH cells fully charged or 24 hours using Alkaline cells. Alkaline cells will not be "charged" by the battery charger.

The unit has LED indicators for Layer 1 signal, alarm and error conditions, Layer 2 and Layer 3 status.

Using the Headset you can receive incoming calls and make outgoing calls to the BT line test facility using the Call/Clear key. When using Icode Auto Test speech utility, you can make a speech call to any number.

The firmware in the unit is stored in FLASH memory and may be upgraded via the PC COM port with the Upgrade (Windows) utility.
Quick Start

Battery Charging

The AA size NiMH batteries are shipped uncharged so first you must charge your ISDN30 Simulator NiMH batteries. Remove the battery cover, insert the 2 NiMH AA cells and replace the cover. Insert the dc plug of the mains plug top dc battery charger into the dc socket at the bottom end of the unit.

The ISDN30 Simulator will turn on automatically and the green Battery charging LED will flash green. Leave the unit to charge for approximately 6 hours after which time the LED will remain green continuously.

If you are unable to recharge the NiMH batteries you can use alkaline AA batteries if you wish. Alkaline batteries will not be charged when using the dc battery charger.

TE-S (PBX) Mode

Connect the ISDN30 Simulator to the NTE using the standard RJ45 to RJ45 8 way cable, two BNC cables or 2 BNC to type 43 cables as appropriate for the NTE.

Turn the unit on by pressing and holding the I/O button for > 1 second. The unit defaults to ISDN30e (ETSI) TE-S Loopbox mode when switched on. If the bearer protocol is DASS2, the unit will auto detect and configure to the DASS2 protocol at Layer 1, 2 and 3.

Up to 30 incoming B channels calls can be auto answered.

Incoming data calls are immediately auto answered and the B channel is looped back to enable BERT testing from the calling end e.g IFETS or an ISDN hand held tester. Incoming voice calls will stay in the Alerting state, indicated by a flashing LED and audible ringer,
for 5 seconds before being automatically connected to the Headset port.

**TE-S (PBX) Mode RJ45 120ohm**

```
| RJ45 cable | NTE |
| ISDN30 Simulator | Exchange line |
```

**TE-S (PBX) Mode BNC 75ohm**

```
| OUT | IN |
| IN | OUT |
| NTE | Exchange line |
| ISDN30 Simulator |
```

**NT-M (ET) Mode**

Connect the ISDN30 Simulator to the PBX or in bound exchange transmission equipment using the standard RJ45 to RJ45 8 way cable, or two BNC to BNC (or BNC to type 43) coaxial cables as appropriate.

Turn the unit on by pressing and holding the I/O button for > 1 second. The unit defaults to ISDN30e (ETSI) TE-S (PBX) mode when switched on, so you need to press the NT-M (ET) Mode button to select NT-M (ET) mode. The adjacent indicator LED will flash green when NT-M (ET) Mode is selected. If the PBX bearer protocol is DASS2, the unit will auto detect and configure to the DASS2 protocol at Layer 1, 2 and 3.
Upon selection of NT-M (ET) mode the RJ45 socket transmit and receive pairs are switched internally so that you can use the standard RJ45 cable to connect to the CPE equipment. The BNC OUT and IN connectors remain transmit signal and receive signal respectively for both TE-S (PBX) and NT-M (ET) Modes.

Up to 30 incoming B channel calls can be auto answered.

Incoming data calls are immediately auto answered and the B channel is looped back. Incoming voice calls will stay in the Alerting state, indicated by a flashing LED and audible ringer, for 5 seconds before being automatically connected to the Headset port.
Monitor Mode

Bridge the ISDN30 Simulator onto the PBX to NTE RJ45 lead with the dual outlet adapter, or two BNC T connectors and cables as appropriate. In Monitor Mode the IN and OUT connections are switched to act as line receivers for the NTE OUT and IN signals respectively. The inputs are set to high impedance to avoid loading the terminated transmission line. The bridging connection leads should be kept as short as possible to minimise signal reflections.

Turn the unit on by pressing and holding the I/O button for > 1 second. The unit defaults to TE-S (PBX) ISDN30e (ETSI) Loopbox mode when switched on, so to select Monitor mode press the Monitor button. The adjacent indicator LED will flash green when Monitor Mode is selected. The unit stores up to the last 11,000 protocol frames and may be left stand alone or connected to a PC running ICode Auto Test.

Monitor Mode RJ45 120ohm
Monitor Mode BNC 75ohm

ISDN30 Simulator

BNC T connectors

Exchanger

ISPBX

BNC IN

BNC OUT

BNC OUT

ISDN30 Simulator

BNC IN

NTE

Exchange line
ISDN30 Simulator Operation

Layer 1
- Rx Signal
- CRC4

Alarms
- LOS
- AIS
- LFA
- RAI
- E Bit

Errors
- FAS
- CRC4

Layer 2
- ISDN30e
- DASS2

Layer 3
- Call Active Alerting

BT ISDN30 SIMULATOR

Battery charging

Mode
- TE-S (PBX)
- NT-M (ET)
- Monitor

I/O
- 12Vdc
- 2.5mm dc socket
- 9 way D

Headset

PC

Call/ Clear

RJ11
ISDN30 Simulator

LED Indicators

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<th>Description</th>
<th>LED condition</th>
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<tr>
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<td>AIS</td>
<td>all 1s Alarm Indication Signal</td>
<td>flash red</td>
</tr>
<tr>
<td>LFA</td>
<td>loss of frame alignment</td>
<td>flash red</td>
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<tr>
<td>RAI</td>
<td>remote/distant alarm</td>
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<tr>
<td>E BIT</td>
<td>distant CRC4 multi frame alarm</td>
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<td><strong>Errors</strong></td>
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<td>Call Active</td>
<td>One or more active calls</td>
<td>flash green</td>
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<tr>
<td>Alerting</td>
<td>Alerting state for an incoming Voice call</td>
<td>flash green</td>
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<td><strong>TE-S (PBX)</strong></td>
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<td></td>
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<tr>
<td>TE-S (PBX)</td>
<td>Simulates terminal side signalling</td>
<td>flash green</td>
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<tr>
<td><strong>NT-M (ET)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NT-M (ET)</td>
<td>Simulates network side signalling</td>
<td>flash green</td>
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<td><strong>Monitor</strong></td>
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<td></td>
</tr>
<tr>
<td>Monitor</td>
<td>Passive monitor NTE to PBX IN &amp; OUT</td>
<td>flash green</td>
</tr>
<tr>
<td><strong>Battery Charging</strong></td>
<td></td>
<td>flash green/continuous</td>
</tr>
</tbody>
</table>

Audible Alarm

When a major alarm or major error condition is detected, in addition to the LED indication, the unit will sound an audible alarm generated.
by an internal piezo electric sounder. The alarm may be cancelled by pressing the Call/Clear button. The alarm will sound for:

- LOS
- LFA
- ERRORS > 1 in $10^3$

Low battery is indicated by 3 short beeps at 1 minute intervals.

When in the Alerting state the sounder will emit cadenced ringing.

**Push Button Functions**

The unit has push buttons behind the plastic front panel label with the following functions:

- I/O  ON/OFF press for > 1 second.
- NT-M (ET) Mode  Simulates network side protocol for ISDN30e and DASS2 allowing connection of PBXs and in bound exchange transmission equipment
- Call/Clear  Cancels the Audible Alarm. Initiates a headset call to the BT line test facility. When pressed simultaneously with I/O the unit is put into firmware download mode through the RS232 port from a PC running the upload utility.
- Monitor Mode  Passive monitor on both IN and OUT ports of the NTE-PBX protocol at Layer 1, 2 and 3.

**Connectors**

**RJ45 120 ohm**

**TE-S (PBX) Mode (default on power on)**
The ISDN30e TE-S interface is provided by an RJ45 socket where:
- pins 1 and 2 receive from NTE
- pins 4 and 5 transmit to NTE

**NT-M (ET) Mode**
The ISDN30e NT-M (ET) interface is provided by an RJ45 socket where:
**ISDN30 Simulator**

- pins 1 and 2 transmit to PBX
- pins 4 and 5 receive from PBX

ISDN30e signal levels are 3Vpk nominal, 120ohm, balanced.

**BNC 75 ohm**

Signal levels are 2.37Vpk nominal, 75 ohm, unbalanced. IN is the received signal for both TE-S (PBX) and NT-M (ET) modes. OUT is the transmit signal for both TE-S (PBX) and NT-M (ET) modes.

**Headset**

The headset may be connected to the RJ11 headset port. In standalone mode you will be able to talk and listen on an incoming voice call which will be auto answered by the ISDN30 Simulator after 5 seconds. You can make and clear an outgoing speech call to the BT line test facility by pressing the **Call/Clear** key.

When using ICode Auto Test Laptop software, you can initiate an outgoing voice call to any number of your choice using the ICode speech call tool button and dialogue. (See ICode Auto Test manual for details).

**RS232 Serial Port**

9 way D female

- Baud rate: 115200
- Data bits: 8
- Parity: none
- Stop bits: 1
- Flow control: Xon/Xoff

Pin out:

1. connected to 4 and 6
2. ISDN30 Simulator transmit data
3. ISDN30 Simulator receive data
4. connected 1 and 6
5. signal ground
The RS232 port has two functions.

**ICode mode:**
The normal mode of operation of the RS232 port sends an ICode Auto Test software compatible binary output of the D channel protocol in real time. Results of test sequences are filtered into the Live Test Results window of ICode Auto Test. The ISDN30 Simulator stores up to the last 11,000 frames of protocol and up to 6 sets of Auto Test results text in its non-volatile store.

The ICode command **Download Monitor Memory** will read the entire contents of the ICode compatible event store into ICode allowing you to store the decoded events file on your PC. The ISDN30 Simulator ICode event store can be reset by the ICode command **Erase Monitor Memory**. When the ICode event store is full the events "wrap" with the newest events overwriting the oldest.

For more on using ICode Auto Test, please refer to the ICode Auto Test User's Guide on the ICode Auto Test CD.

**Firmware Upgrade:**
When the Firmware Upgrade Windows utility is run on a PC connected to the ISDN30 Simulator RS232 serial port, the port receives the downloaded firmware upgrade to the ISDN30 Simulator FLASH memory. To activate this mode, when prompted to do so by the Upgrade utility on screen instructions, hold down the Call/Clear and I/O buttons until you hear the unit beep.
ISDN30 Simulator

Power
dc jack
The ISDN30 Simulator will draw power from either:

- The 12Vdc power supply input plugged into the 2.5mm dc socket
- The 2 AA NiMH rechargeable batteries.

The ISDN30 Simulator will operate from the dc power supply without its batteries fitted, or when the batteries are flat.

If there is no network activity on the network interface connections, then the unit will switch off after 5 minutes.

Low Battery Warning
When the ISDN30 Simulator batteries become discharged, a battery low warning of 3 sounder beeps will occur every minute until the unit switches off. You will have approximately 20 minutes of testing time left when the battery warning starts.

Charging the NiMH Batteries
To charge the NiMH batteries, insert the plugtop supply into a convenient mains socket and insert the dc jack into the ISDN30 Simulator dc socket. If the ISDN30 Simulator is not already on, it will turn on immediately. Leave the ISDN30 Simulator to charge for approximately 6 hours.

Using Alkaline Batteries
If you are unable to gain access to a mains supply to recharge the batteries, alkaline AA batteries may be used. To change the batteries remove the battery cover retaining screw on the rear of the unit, take off the battery cover and replace the batteries and cover. The ISDN30 Simulator battery charging circuit will not charge alkaline batteries.

✔️ Caution!!
Disconnect all telecommunications network connections before opening the battery compartment.

**Waste Disposal Hazard**
The ISDN30 Simulator contains a lithium cell for the purpose of memory backup. This cell and the electronic circuit board with components must be disposed of in accordance with applicable EU directives.

**Testing with ICode Auto Test PC Software**
To operate the ISDN30 Simulator with ICode Auto Test, install and run the ICode Auto Test program on your PC from the CD provided and connect the PC to the ISDN30 Simulator with the serial cable.

ICode Auto Test will operate with the ISDN30 Simulator in TE-S (PBX), NT-M (ET) and Monitor modes.

In TE-S (PBX) mode (the default on power on) ICode Auto Test controls the ISDN30 Simulator to run through a test suite and will store the test results and associated ICode compatible Layer 1, 2 and 3 protocol trace for later upload to ICode Auto Test PC/laptop software or alternatively the auto test results can be immediately saved on the PC. The tests to be performed can be selected from the **Scorpion Auto Test & Configuration** dialogue box tab menus, with the default being all tests selected. The tests that can be performed in the Auto Test sequence are:

- BERT (bit error rate test) line quality
- Channel test for outgoing and incoming call support
- Basic Service network support tests
- Select Service network support tests
- Received signal level, battery voltage and clock frequency

ICode Auto Test is also a powerful ISDN30e ETSI and DASS2 protocol analyser in real time and post data capture. To open the
decode window select **View - Display Decode** command or click on the Display Decode tool button.

In NT-M (ET) mode you can run an Auto Test sequence with the exception that the Basic Service tests are limited to bearer only tests, and the Supplementary Service (Select Service) tests are not supported.

In Monitor Mode you can only use the main decode window. Note that this defaults to being closed and so you should open it with the **View - Display Decode** command or click on the Display Decode tool button.

Full details for operating ICode Auto Test are contained in the separate ICode Auto Test User's Guide, which is on your CD and installed to your PC's Programs menu during ICode installation.

**ISDN30 Simulator Firmware Upgrade**

The ISDN30 Simulator firmware is stored in FLASH memory, which allows you to upgrade the firmware release from your Laptop or PC.

To upgrade your ISDN30 Simulator carry out the following steps.

**Step 1**

Copy the upgrade file onto your hard drive in a directory of your choice. For example the path:

C:\ISDN30 Simulator \ISDN30 Simulator V2.00-0752.exe

firmware build no version number
**Step 2**
Use the serial cable to connect your ISDN30 Simulator RS232 port to a free COM port on your Laptop or PC.

**Step 3**
Run the ISDN30 Simulator upgrade file by double clicking on the filename and follow the on screen instructions. To turn on the ISDN30 Simulator into the download mode, press the Call/Clear button and I/O button simultaneously until you hear the unit beep.
ISDN30 Simulator Specifications

PRI Interface
RJ45: TE-S (PBX) Mode: pins 1,2 Receive, Pins 4,5 Transmit
      NT-M (ET) Mode: pins 1,2 Transmit, Pins 4,5 Receive
      120ohm mode signal 3Vpk nominal
BNC: 75ohm mode signal 2.37Vpk nominal
      OUT Transmit (both TE-S (PBX) and NT-M (ET) Modes)
      IN Receive (both TE-S (PBX) and NT-M (ET) Modes)
Line Code: HDB3, Bit rate: 2.048Mbit/s

ISDN Protocol
Layer 1 ETS300 011-1
Layer 2 ETS300 125
Layer 3 ETS300 102-1/2
DASS2 BTNR190

BERT Tests (with ICode Auto Test)
Bearer: Speech, 3.1kHz, Data
Pattern: $2^9-1$, $2^{11}-1$, $2^{15}-1$ inverted
Time: 1min, 5min, 1hour continuous
Loopbox (incoming call): Loopback selected bearer, all bearers, none, auto/manual PRBS

Speech Call (with ICode Auto Test)
En bloc signalling
Last 10 number drop down menu for redial

ISDN30e Basic Service Tests (with ICode Auto Test)
Speech bearer, 64kbit/s UDI bearer, 3.1kHz Audio bearer,
Telephony 3.1kHz, Telephony 7kHz, Telefax G4, Videotex,
Videotelephony, Eurofile, FTAM, Telefax G2/3, Teletex.
ISDN30 DASS2 Basic Service Tests (with ICode Auto Test)
Audio 3.1kHz, Data 64kUR, Fax Gr4, Speech Cat1, Speech Cat2, SSTV, Telephony, Teletex, Videotex

ISDN30e Select Service Tests (with ICode Auto Test)
CD, CFB, CFNR, CFU, CLIP, CLIR, COLP, COLR, DDI, MCID, SUB

ISDN30 DASS2 Select Service Tests (with ICode Auto Test)
UUS, OLI, DDI, TLI, CCI, NAE, CD, MCI

Channel Test (with ICode Auto Test)
Outgoing; Remote incoming via self call
30 Channel results list
Bearer selectable

Voltage Test (with ICode Auto Test)
Received signal level in dB relative to nominal level
Internal battery voltage
Received signal frequency deviation from 2.048MHz in ppm

Results Storage
Approximately 11,000 frame Icode compatible store
Approximately 6 sets of test results text

Power
Typical: 300mW
2 x 1.2volt 1200mAh NiMH batteries
Typical Operating time: 8 hours approximately on NiMH batteries
12Vdc 220Vac mains power supply
Battery recharge time: 6 hours

RS232 Port
9 way D female, 115200 baud rate
Icode™ compatible output
Firmware upgrade
**ISDN30 Simulator**

**Headset port**
RJ11 socket: pin 1 electret mic -ve, pin 4 electret mic +ve; pins 2 and 3 receiver

**Weight**
250 gms

**Environmental**
Operating temperature: -10°C to +40°C
Storage temperature: -25°C to +70°C

**Dimensions**
168mm x 88mm x 33mm

**CE and Safety**
EN61000-6-3 emissions
EN55024, IEC61000-3 immunity
EN61000-4-2/5/6/11 mains voltage tests
EN61010-1, EN41003, EN60950
89/336/EC EMC, 93/68/EC amendment
73/23/EC Low Voltage, 92/31/EC Marking
Note: to maintain CE compliance use the leads supplied

**Accessories**
Carry bag
12volt dc mains plug top battery charger
2 AA size NiMH 1.2volt batteries
RJ45 to RJ45 network lead
RJ45 plug to twin socket dual outlet adaptor
2 BNC T adaptors (M/F/F)
2 BNC plug to BNC plug leads
2 BNC plug to type 43 plug leads
9 way D RS232 PC COM port serial lead
Headset
ICode™ Auto Test software CD
This User's Guide
APPENDIX

ETSI Clear Cause Number and Description

1  Unallocated Number
2  No Route to spec Transit Ntwk.
3  No Route to Destination
6  Channel Unacceptable
7  Call Awarded & Being Delivd
16 Normal Call Clearing
17 User Busy
18 No User Respond
19 No Answer from User (Alerted)
21 Call Rejected
22 Number Changed
26 Non-Selected User Clearing
27 Destination Out of Order
28 Invalid Number Format
29 Facility Rejected
30 Response to STATUS ENQUIRY
31 Normal, Unspecified
34 No Circuit/Chan Available
38 Network Out of Order
41 Temporary Failure
42 Switching Equip. Congestion
43 Access Info. Discarded
44 Requested Cct or Chan. Unavail.
47 Resources Unavailable
49 Quality of Serv. Unavailable
50 Requested Facil. Not Subscribed
57 Bearer Capab. Not Authorized
58 Bearer Capab. Not Available
63 Service/Option Not Available
65 Bearer Capab. Not Implemented
66 Channel Type Not Implemented
69 Requested Facil. Not Implemented
70 Only Restricted Dig Info Bearer
79 Service/Option Not Implemented
81 Invalid Call Ref Value
82 Identified Chan Does Not Exist
83 Susp Call Exists But Wrong ID
84 Call Identity In Use
85 No Call Suspended
86 Requested Call ID Been Cleared
88 Incompatible Destination
91 Invalid Transit Ntwk Selection
95 Invalid Message
96 Mandatory IE Missing
97 Message Type Non-Existent
98 Message Incompat With Call State
99 IE Non-existent /Not Implement
100 Invalid IE Contents
101 Message Incompat With Call State
102 Recovery On Timer Expiry
111 Protocol Error Unspecified
127 Interworking Unspecified

**DASS2 Clear Cause Number and Description**

0  Number Unobtainable
1  Address Incomplete
2  Network Termination
3  Service Unavailable
4  Sub Incompatible
5  Sub Changed Number
6  Invalid Request for Supplementary Service
7  Congestion
8  Subscriber engaged
9  Sub Out of Service
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<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<td>10</td>
<td>Incoming Calls Barred</td>
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<tr>
<td>11</td>
<td>Outgoing Calls Barred</td>
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<td>18</td>
<td>Remote Procedure Error</td>
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<td>19</td>
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<tr>
<td>20</td>
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## ETSI Abbreviations

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<td>Advice Of Charge at the End of call</td>
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<td>BER</td>
<td>Bit Error Rate</td>
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<td>BERT</td>
<td>Bit Error Rate Test</td>
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<td>CPN</td>
<td>Called Party Number</td>
</tr>
<tr>
<td>CRC</td>
<td>Cyclic Redundancy Check</td>
</tr>
<tr>
<td>dc</td>
<td>direct current</td>
</tr>
<tr>
<td>DDI</td>
<td>Direct Dialling In</td>
</tr>
<tr>
<td>FTAM</td>
<td>File Transfer And Access Management</td>
</tr>
<tr>
<td>HDB3</td>
<td>High-Density Bipolar 3 (line code)</td>
</tr>
<tr>
<td>HLC</td>
<td>Higher Layer Compatibility</td>
</tr>
<tr>
<td>IE</td>
<td>Information Element</td>
</tr>
<tr>
<td>ISDN</td>
<td>Integrated Services Digital Network</td>
</tr>
<tr>
<td>LOS</td>
<td>Loss Of Signal</td>
</tr>
<tr>
<td>MCID</td>
<td>Malicious Call Identification</td>
</tr>
<tr>
<td>MSN</td>
<td>Multiple Subscriber Number</td>
</tr>
<tr>
<td>NAE</td>
<td>Network Address Extension</td>
</tr>
<tr>
<td>NT-M</td>
<td>Network Termination Master (clock)</td>
</tr>
<tr>
<td>NTE</td>
<td>Network Terminating Equipment</td>
</tr>
<tr>
<td>NT1</td>
<td>Network Termination Type 1</td>
</tr>
<tr>
<td>OCB</td>
<td>Outgoing Call Barring</td>
</tr>
<tr>
<td>OLI</td>
<td>Outgoing Line Identification</td>
</tr>
<tr>
<td>PC</td>
<td>Personal Computer</td>
</tr>
<tr>
<td>PRBS</td>
<td>Pseudo-Random Binary Sequence</td>
</tr>
</tbody>
</table>
ISDN30 Simulator

PRI Primary Rate Interface
RAI Remote Alarm Indication
SUB Sub addressing
TE Terminal Equipment
TE-S Terminal Equipment Slave (clock)
TEI Terminal Endpoint Identifier
TLI Terminating Line Identification
UDI Unrestricted Digital Information
UUS User - User Signalling

**DASS2 Abbreviations**

BTP Backwards Transmission Path before answer
CA Call Arrival message
CAM Call Accepted Message
CAT1 Category 1 call type
CAT2 Category 2 call type
CB Channel Busying (Supplementary Service)
CCF Clear Confirmation message
CCI Call Charge Indication (Supplementary Service)
CCM Call Connected Message
CCRD Call Charge Rate Data (Supplementary Service)
CD Call Diversion (Supplementary Service)
CIM Clear Indication Message
CLI Calling and Called Line Identification (Supplementary Service)
CRM Clear Request Message
CS Channel Seized message
CUG Closed User Group (Supplementary Service)
DA Destination Address
DASS Digital Access Signalling System
DDI Direct Dialling In
DN Directory Number
ET Exchange Termination
FCS Frame Check Sequence
HDLC High-Level Data Link Control
ICB Incoming Call Barring (Supplementary Service)
ICI(C)  Incoming Call Indication (Complete) message
ICI(I)  Incoming Call Indication (Incomplete) message
ISRM(C) Initial Service Request Message (Complete)
ISRM(I) Initial Service Request Message (Incomplete)
KW    KeyWord
LAP    Link Access Protocol
MCI    Malicious Call Identification (Supplementary Service)
MIM(C) Maintenance Information Message (Complete)
NAE    Network Address Extension (Supplementary Service)
NAM    Number Acknowledge Message
N(F)   Receive Sequence Number
NIM    Network Indication Message
N(P)   Send Sequence Number
NTE    Network Terminating Equipment
OCB    Outgoing Call Barring (Supplementary Service)
OLI    Originating Line Identity (element of CLI)
PBX    Private Branch Exchange
RM     Recall Message (Complete or Incomplete)
RM(C)  Recall Message (Complete)
RM(I)  Recall Message (Incomplete)
RRM    Recall Rejection Message
SABMR  Set Asynchronous Balanced Mode Restricted frame
SCI(C) Subsequent Call Indication (Complete) message
SCI(I) Subsequent Call Indication (Incomplete) message
SeSR   Send Service Request message
SIC    Service Indicator Code
SM     Swap Message
SRW    Service Request Withheld
SSRM(C) Subsequent Service Request Message (Complete)
SSRM(I) Subsequent Service Request Message (Incomplete)
SSTV   Slow Scan Television
TLI    Terminating Line Identity (element of CLI)
UA     Unnumbered Acknowledgement frame
UDC    User Data Control message
UI(C)  Unnumbered Information (Command) frame
UI(R)  Unnumbered Information (Response) frame
UUD(C) User-to-User Data (Complete) message
UUD(I) User-to-User Data (Incomplete) message
UUS User-User Signalling (Supplementary Service)
WSR Withhold Service Request message