HARRIS

TS350®

**Basic Rate
Euro ISDN
Test Set**

User's Guide V2

TS350® *Basic Rate Euro ISDN Test Set*

Harris Corporation has a policy of continuous product improvement, and therefore the specification of this product may be subject to change. Whilst every effort has been made to ensure the accuracy of this User's Guide at the time of printing, Harris Corporation will not be liable for any errors.

If you find any errors in this User's Guide or would like to make suggestions for improvement please send your comments to Harris Corporation at the address below.

The content of this User's Guide is proprietary and neither the whole nor any part thereof may be used, copied or reproduced in any form without the prior permission of Harris Corporation.

Contents

4

TS350 Package

Your TS350 Basic Rate Euro ISDN test set package contains the following items:

- The TS350 test set
- Carry bag
- 12volt dc mains plug top battery charger
- 2 AA size NiMH 1.2volt batteries
- RJ45 to RJ45 BRI interface lead
- RJ11 (7mm-pins 2 and 3) to twin croc clip U interface lead
- RJ11 (7mm-pins 1 and 4) to twin croc clip analogue PSTN lead
- 9 way D female to 9 way D male PC RS232 serial lead
- This User's Guide

TS350 Introduction

The TS350 is a versatile, light, robust and feature rich ISDN basic rate test set for use by telephone company technicians and engineers when installing, commissioning and maintaining ISDN basic rate lines.

The TS350 can make an ISDN speech, data, or BERT call. It can monitor the protocol on the ISDN line and when used with the Genius™ ISDN Protocol Analyser software it makes an extremely powerful maintenance tool. The TS350 has an internal store of messaging protocol at Layer 1, 2 and 3 which can be inspected on screen.

The TS350 has comprehensive test suites for making outgoing and incoming Bit Error Rate Tests (BERT) to assure line quality; automatic or manual Teleservice support tests; and automatic or manual Supplementary service provisioning tests.

For ease and convenience of testing combined analogue and ISDN NTs (Network Termination), the TS350 has a PSTN analogue telephone mode which supports Pulse and DTMF dialling, line voltage measurement, and last number redial.

The TS350 has 2 rechargeable AA size NiMH batteries, which will give approximately 12 hours battery life before you need to recharge with the charger provided in your package.

The 100 x 64 pixel LCD graphics display has a backlight with contrast adjustment to provide clear and detailed information on call status, ISDN signalling in real time and stored test results.

Quick Start

Battery Charging

The AA size NiMH batteries are shipped uncharged so first you must charge your TS350 NiMH batteries. Insert the dc plug of the mains plug top dc battery charger into the dc socket at the bottom end of the unit.

RJ45
ISDN S/T
Pins 3,6 Tx
Pins 4,5 Rx
Pins 7,8 PS2

RJ11 (7mm)
ISDN U pins 2 & 3
PSTN pins 1, 4

DC battery
charger socket
2.5mm
12VDC
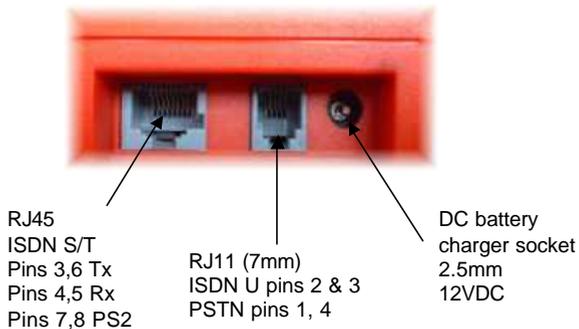
The TS350 will turn on automatically displaying the start up screen sequence. Leave the unit to charge for approximately 16 hours.

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.

Making a BER test

The TS350 has default values set as follows for the BERT test:

Bearer: Data *(64k unrestricted digital information)*
Loops: Bearer *(for incoming BERT calls)*
Pattern: 2^{11}-1 *(Pseudo random test pattern)*
Test time: 1 min
Test Thresholds; Errors: 1

You can use these values to make your first BERT test.
Note: For more detail on these options and their use see the appropriate section in this User's Guide.

To make your first BERT call:

Step 1
Connect your TS350 with the RJ45 to RJ45 lead to the NT interface S/T bus socket.

Step 2
Switch on the TS350 by holding down the Ⓘ key for 2 seconds. The TS350 turns on, beeps and displays its start up screen sequence.

You will be presented with the **Mode** selection screen. Select **ISDN S - TE** by pressing the ⬚ (select) key. (Note all menu items that are reverse contrast are selected using the ⬚ key).

```
Mode              14:20  ▐
ISDN S-TE             1  ▌
ISDN S-Monitor       2
ISDN U-TE            3
PSTN                 4

```

Step 3
Select **BER Test** by pressing 🎵

```
Test Menu        14:20  ▮
BER Test             1
Speech               2
3.1kHz Audio         3
Teleservices         4
```

Step 4
Select **BERT** from the **BER test** menu

```
BER Test         14:20  ▮
BERT                 1
Bearer:Data          2
Loopbox:Bearer       3
Pattern: 2¹¹-1       4
```

Step 5
Enter the B channel number (default is 1) to make an outgoing call on and press 🎵 .

```
BER Test         14:20  ▮
Enter B ch#: 1
Bx
```

Step 6
You are prompted to **Enter number:**

```
BER Test         14:20  ▮
Enter Number:
01633123456
```

9

Enter the ISDN number of the line under test and press 🎵 to make the call.

The call is switched back onto the other B channel selected by the network. You will see the Layer 2 and Layer 3 messages displayed on the lower part of the screen.

The TS350 auto answers the incoming call and loops back the BERT pattern $(2^{11}-1)$, which is received on the outgoing channel.

*Note: For a self call the incoming B channel always auto answers and loops the data regardless of the **Loopbox** menu settings which are intended for incoming BERT calls from another tester.*

The TS350 displays the BERT test results menu and the test will be automatically ended after the test time, in this case 1 minute.

```
BER Test          14:20 🔋
C=Stop *=Reset #=Err
Return to menu
E:0 ES:0 SES:0
Time left  00:00:59
L2 USR RR_C   TEI=0
B2 DATA IN PRBS
```

The results screen is displayed.

```
BER Test          14:20 🔋
  **Test Passed**

E:0 ES:0 SES:0
Time time  00:01:00

ALL CHANNELS IDLE
```

Step 7

To return to the **Test menu** press the C key.

To turn off the TS350 press the ⓪ key until the screen blanks (approximately 2 seconds).

Making a Speech Call

Step 1
Connect your TS350 with the RJ45 to RJ45 lead to the NT S/T interface socket.

Step 2
Switch on the TS350 by holding down the ⓪ key for 2 seconds. The TS350 turns on, beeps and displays its start up screen sequence.

Step 3
From the Mode menu select ISDN S-TE.

```
Mode              14:20 ▐█
ISDN S-TE             1  ▌
ISDN S-Monitor       2
ISDN U-TE            3
PSTN                 4
```

Step 4
Scroll the reverse contrast cursor down to highlight **Speech** by pressing the ▼ (scroll down) key once. Select **Speech** call by pressing ⌥
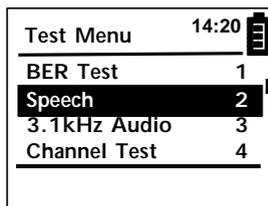
```
Test Menu         14:20 ▐█
BER Test             1
Speech               2  ▌
3.1kHz Audio         3
Channel Test         4
```

11

Step 5
Enter the B channel number (default is 1) on which to make an outgoing and press 🎵

```
┌─────────────────────────┐
│ Speech Call      14:20 ▌│
│ ──────────────────────  │
│ Enter B ch#: 1          │
│ Bx                      │
│ Dial: Overlap           │
│ ──────────────────────  │
│                         │
└─────────────────────────┘
```

Step 6
You are prompted to **Enter number:**
Enter the number you wish to dial.
Note: The default dial mode is **Overlap** *and in this mode the digits are signalled as they are entered.*

```
┌─────────────────────────┐
│ Speech Call      14:20 ▌│
│ ──────────────────────  │
│ Enter Number:           │
│ 01633123123             │
│                         │
│ L2 USR RR_C  TEI=0      │
│ L3 USR INFO             │
└─────────────────────────┘
```

You will then see the call in progress screen.

```
┌─────────────────────────┐
│ Speech Call      14:20 ▌│
│ ──────────────────────  │
│ Called Number:          │
│ 01633123123             │
│ C=Clear, ▲=KEYPAD       │
│ Return to Menu          │
│ L2 USR RR_C  TEI=0      │
│ B1 SPEECH OUT           │
└─────────────────────────┘
```

Step 6
To end the call, press the Ⓒ key.

Receiving a Voice Call

When your TS350 receives a compatible incoming Setup message (incoming call) it will ring the sounder and prompt you with the screen:
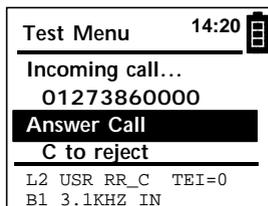
```
Test Menu        14:20
Incoming call...
  01273860000
Answer Call
  C to reject
L2 USR RR_C  TEI=0
B1 3.1KHZ IN
```

To answer the call press the 🎵 key and you will be able to talk to the calling party. You will then be presented with the call in progress screen:

```
Test Menu        14:20
Caller Number:
  01273860000
C=Clear,▲=KEYPAD
Return to Menu
L2 USR RR_C  TEI=0
B1 3.1KHZ IN
```

If you wish to end the call, press the [C] key or just wait for the calling party to clear the call. After call clearing you will be returned to the TS350 **Test Menu**.

13
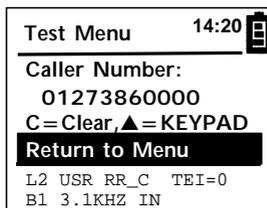
TS350 Operation

Display

The display is a backlit graphics LCD display with a resolution of 100 x 64 pixels. When operated only on the batteries, the backlight will turn on after each key press and turn off after one minute. If the TS350 is powered from the dc supply, then the backlight will remain on all the time.

The screen is split into three sections as shown below.
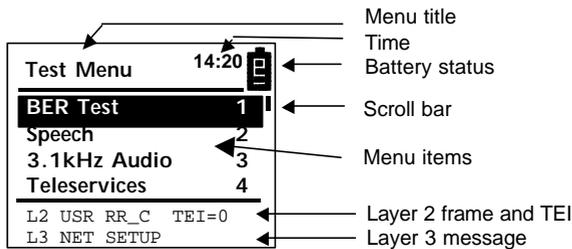
The top section displays the menu title, battery status, and time.

The mid section displays user selectable menu items, call status, and test results. The menu item shown in reverse contrast may be selected by pressing the ⏎ key.

The bottom section displays Layer 2 frame types, TEI (Terminal Endpoint Identifier) value, Layer 2 error messages, Layer 3 message type, and Layer 3 error messages. These messages persist for 1S and show the messaging activity as it occurs. The last 200 lines of protocol are stored in the TS350 protocol trace store for inspection after a test sequence has been performed.

LED Indicators
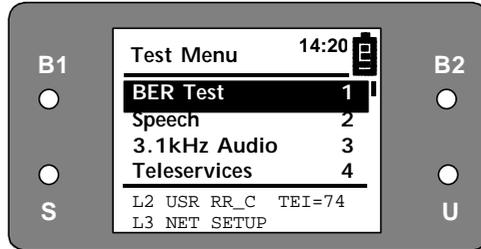
B1   Flashes green when the B1 channel is active. The LED is Off
        when the B1 channel is not in use.

B2   Flashes green when the B2 channel is active. The LED is Off
        when the B2 channel is not in use.

S   S interface status indicator.
        Flashes green if Layer 1 is activated and both INFO 3 and
        INFO 4 states have been received.
        Flashes red if a signal is detected but INFO 3 and INFO 4
        states have not been received. This indicates a Layer 1
        activation failure.
        If no signal or voltage is present, then this LED is off.

U   U interface status indicator.
        Flashes green if synchronisation and Layer 1 activation has
        occurred.
        Flashes red whilst synchronisation and activation is in
        progress or has failed. *Note: The U interface can take up to 20
        seconds or so to synchronise and activate.*

15

TS350® Basic Rate Euro ISDN Test Set

Key Functions

Number keys:

ABC
2
- Enter dialled digits.
- Select menu items irrespective of cursor position.
- KEYPAD IE: during an ISDN call numbers are sent as keypad information elements if KEYPAD is selected.
- DTMF tones: during a call numbers are sent as DTMF tones if DTMF is selected.

*
- During en bloc CPN entry denotes the characters following the * are a sub address.
- KEYPAD IE: during an ISDN call * can be sent as a keypad information element if KEYPAD is selected.
- DTMF: during a call * is sent as a DTMF tone tones if DTMF is selected.
- During a BERT: restarts the test and clears error counters.
- Resets the Trace or CLI Log when selected.

LD/MF
#
- KEYPAD IE: during an ISDN call # is sent as a keypad information element if KEYPAD is selected.
- DTMF tones: during an ISDN call # is sent as a DTMF tone if DTMF is selected.
- During a BERT: inserts a single bit error.
- In PSTN mode during a call: toggles between loop disconnect (pulse) and DTMF dialling.

▲
- Scroll up through menu items.
- In Test Results, Trace listing and CLI Log: short press scrolls up 1 line; long press (>1 sec) scrolls up six lines at a time; press and hold pages up 6 lines every second.

▼
- Scroll down through menu items.
- In Test Results, Trace listing and CLI Log: short press scrolls down 1 line; long press (>1 sec) scrolls down six lines at a time; press and hold pages up 6 lines every second.

[C]
- In menu listings: go back up one menu level.
- During a BERT: stops the test.
- During a call: clears the call.
- In the results screen: clears the results screen.
- During dialling: short press deletes the last digit; long press (>1) aborts dialling and returns you to the **Test Menu**.

[♪]
- Select a reverse contrast menu item.
- Select a reverse contrast function.
- Dial a reverse contrast number.

[①]
- Press and hold > 2 second to switch on the TS350.
- Press and hold > 2 seconds to turn off the TS350.

TS350® Basic Rate Euro ISDN Test Set

Connectors
Network and dc battery charger

RJ45 ISDN
S/T pin 1 left
Pins 3,6 Tx
Pins 4,5 Rx
Pins 7,8 PS2

RJ11 (7mm) pin 1 left
ISDN U pins 2 & 3
PSTN pins 1, 4;

DC battery
charger socket
2.5mm
12VDC
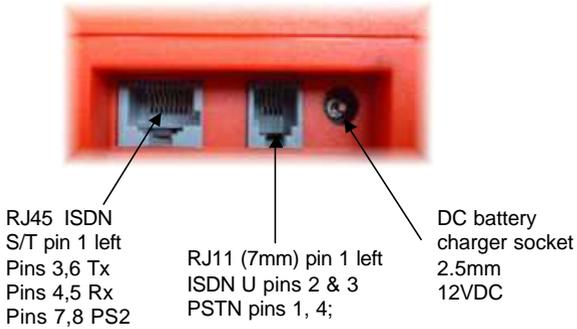
RS232 Serial Port

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   TS350 transmit data
    3   TS350 receive data
    4   connected 1 and 6

5	signal ground
6	connected to 1 and 4
7	connected to pin 8
8	connected to pin 7
9	not connected

The RS232 port has two functions.

Genius mode:
The normal mode of operation sends a Genius software compatible binary output of the D channel protocol. In ISDN S-TE and ISDN U-TE mode this protocol is the TS350 to Network protocol; in ISDN S-Monitor passive monitor mode this is D channel protocol generated by the TE and the Network.

Download mode:
When the Upgrade Windows PC application is run the serial port receives the downloaded firmware upgrade to the TS350. To activate this mode hold down the C key and turn on the unit until you hear the beep. The screen will be blank until downloading starts.

Powering

The TS350 intelligently draws its power from available external sources, drawing power from the batteries only when no other power source is available.

The TS350 will draw power from:

- Normal power S bus PS1
- Restricted power S bus PS1
- S bus P S 2
- A powered U interface
- The 12VDC Power supply input

or if none of the above are available:

- The 2 AA NiMH rechargeable batteries.

The TS350 will operate from any of the external power sources without its batteries fitted, or when the batteries are flat.

When operating from an external power source the LCD backlight will be on all the time the unit is operating, and the unit will stay on regardless of the activity on the network interfaces.

When operating from the batteries, the backlight will turn on when any key is pressed and timeout 1 minute after the last key press to conserve battery power. If there is no network activity on the Network interface connections, then the unit will switch off after 5 minutes. This is to conserve battery power and to avoid battery discharge if the unit is accidentally turned on.

Low Battery Warning

When the TS350 batteries become discharged, a battery low warning of 3 sounder beeps will occur every minute until the unit switches itself off. You will have approximately 5 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 TS350 dc socket. If the TS350 is not already on, it will turn on immediately. Leave the TS350 to charge for approximately 16 hours. Whilst the dc plugtop supply is on you will see a plug icon in the top right hand corner of the LCD.

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 two battery cover retaining screws on the rear of the unit,

take off the battery cover and replace the batteries. The TS350 battery charging circuit will not charge alkaline batteries.

Positive polarity

✎ *Caution!!*
Disconnect all telecommunications network connections before opening the battery compartment

Positive polarity
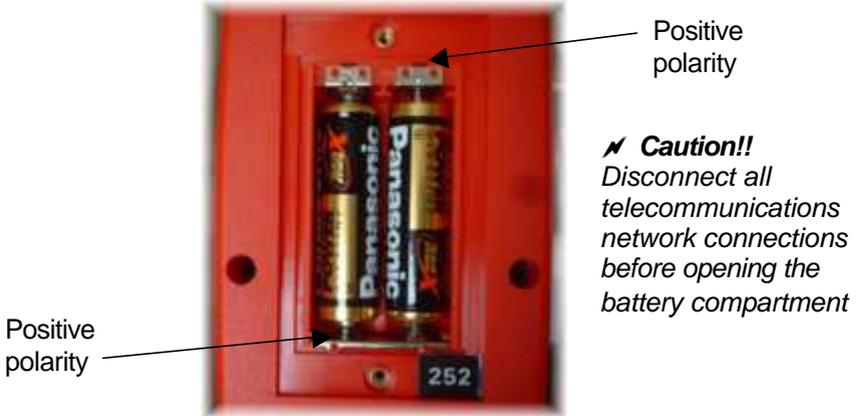
TS350 Configuration Modes

The TS350 can be used in four network interface operating modes which are selected from the **Mode** menu.

ISDN S - TE

Connect the TS350 to the NT1 S interface socket using the RJ45 lead provided. In this mode the TS350 will act as an ISDN terminal connected to the four wire S/T bus. The TS350 can carry out a BERT test on any bearer, make a voice call, carry out manual or automatic tests for Teleservice network support and common Supplementary

service support. The mode is automatically selected if the S interface is active or carries phantom power. If the S bus has no phantom power and is deactivated the mode may be selected from the initial **Mode** menu.

ISDN S - Monitor

In this mode the TS350 is "bridged" onto the S bus link between the TE and the NT. The TS350 passively monitors D channel messaging in bothTE to NT and NT to TE directions. The binary decode is output on the RS232 port in real time for decode with the Genius ISDN Protocol Analyser software. A simplified protocol trace is shown on the screen scrolling in real time. The parameters to be displayed are selected in the **Setup** menu in the sub menu **Trace.**

ISDN U - TE

Connect the TS350 to the two wire U interface with the crocodile clips on the U interface lead provided. In this mode the TS350 will act as an ISDN terminal connected to the two wire U interface and replaces the NT1. The TS350 can carry out a BERT test on any bearer, make a voice call, carry out manual or automatic tests for Teleservice network support and common Supplementary service support. The mode is automatically selected if the U interface is DC powered or may be selected manually from the **Mode** menu.

PSTN

Connect the TS350 to the analogue interface with the crocodile clips either connected directly to the pair or to a PSTN socket adapter. In this mode the TS350 acts as an analogue test telephone and supports DTMF or Pulse (loop disconnect) dialling, and line voltage measurement. The mode is particularly useful when testing combined analogue and ISDN network termination units (NTs). The interface is automatically selected if a PSTN line voltage is detected and no other interfaces are active or may be selected manually from the **Mode** menu.

ISDN BRI Testing

The ISDN **Test Menu** is available in the **ISDN S - TE** mode and the **ISDN U - TE** modes.

BER Test

The BER (bit error rate) test is selected from the **Test Menu** which is presented after you have selected **ISDN BRI - TE** from the **Mode** menu.

```
Test Menu        14:20  ▐
BER Test             1  ▌
Speech               2
3.1kHz Audio         3
Teleservices         4
L2 USR INFO   TEI=0
L3 USR SETUP
```
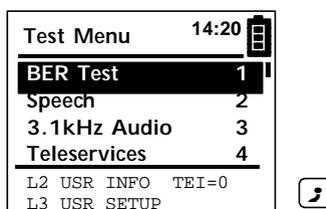
When the interface has activated the S or U interface LED will flash green. Whilst activation is in progress or if it has failed, the LED will flash red.

To make a BER test (BERT), select the outgoing channel by entering the channel number[1] (either 1 or 2) for making the call and then pressing the 🎵 (select) key to select the channel. Either enter a remote test number or for a self call test, your own number, and then press the 🎵 key again to setup the call.

To allow the network to assign the outgoing channel number, select Bx.

The screen sequence is as follows:

```
BER Test          14:20
BERT                  1
Bearer:Data           2
Loopbox:Bearer        3
Pattern: 2¹¹-1        4
```

```
BER Test          14:20
Enter B ch#: 1
Bx
```

```
BER Test          14:20
Enter Number:
01633123456

L2 USR INFO   TEI=0
L3 USR SETUP
```

Upon connection of the call you will be presented with the test results screen:

```
BER Test          14:20
C=Stop *=Reset #=Err
Return to menu
E:0 ES:0 SES:0
Time left  00:00:59
L2 USR RR_C   TEI=0
B1 DATA OUT PRBS
```

The test results are shown in real time:

- **E** is the bit error count
- **ES** is the errored second count
- **SES** is the severely errored second count
- **Time left** is shown counting down from the preset test time, (or if **Cont** is set in the BERT setup options then the **Test time** counts up).

If you wish to restart the test, press the ✳ key to reset the **Time left** and error counters.

To insert a single bit error in the PRBS test pattern, press the #️ key.

If you wish to make a voice call whilst your BERT is running, then press the ♪ during the test to return to the **Test Menu** and select **Speech** or **3.1kHz Audio**. Then proceed to make the call as described later in this guide. During or after your speech call, to go back to the test results menu select **BER Test** from the main menu.

The test will automatically stop when the test time is complete. The test can be stopped at any time by pressing the Ⓒ key, which clears the outgoing call.

When the test is complete you are presented with the test results screen:

```
┌─────────────────────────┐
│ BER Test       14:20 █  │
│ ─────────────────────── │
│    **Test Passed**      │
│                         │
│ E:0 ES:0 SES:0          │
│ Time time  00:01:00     │
│                         │
│ ALL CHANNELS IDLE       │
└─────────────────────────┘
```

To clear the results screen and return to the BER test menu press the $\boxed{C}$ key.

BER Test Options

The BER test sub menu options are listed in the BER test menu. Using the scroll down arrow key you can see all the options.

Note: When there are more menu items than are shown in the menu window, you will see a scroll bar.

```
BER Test          14:20
BERT                1
Bearer:Data         2
Loopbox:Bearer      3
Pattern: 2^11-1     4
```
$\boxed{\blacktriangledown}$

```
BER Test          14:20
Pattern: 2^11-1     4
Test Time: 1 min    5
G.821 Results       6
Test Thresholds     7
```
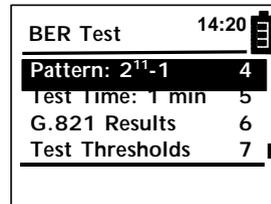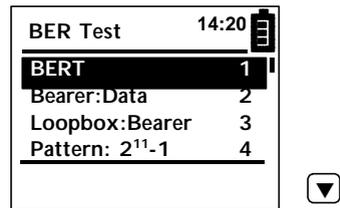
Use the $\boxed{\blacktriangledown}$ or $\boxed{\blacktriangle}$ keys to highlight the menu option required and then press the $\boxed{\;}$ key to select a menu option. The selected item in any option menu is shown with a * following the option name.

Bearer

Selects the bearer type menu that the outgoing or incoming BERT uses to carry the PRBS test pattern.

```
┌─────────────────────────┐
│ BER Test        14:20 ▓ │
│ ▐Data *             1▌  │
│ Speech              2   │
│ 3.1kHz  Audio       3   │
│                         │
│                         │
└─────────────────────────┘
```

Loopbox

Selects the menu for how the tester responds to an incoming BERT test on any channel originated from a remote tester, which may be another TS350, or any other compatible commercial tester.

```
┌─────────────────────────┐
│ BER Test        14:20 ▓ │
│ ▐Bearer *           1▌  │
│ All                 2   │
│ None                3   │
│ ManPRBS             4   │
│ AutoPRBS            5   │
└─────────────────────────┘
```

Bearer: Selects the bearer selected in the Bearer menu (above) that will be automatically looped upon receipt of a compatible call. The incoming receive pattern is looped back onto the transmit side of the bearer channel. This function will operate whatever the test menu state when an incoming call is received, even if a test call is in progress on another channel.

In this mode the TS350 cannot clear the incoming call, which must be cleared by the remote tester. This is to avoid tampering when the TS350 is left unattended.

All: Any incoming call on any bearer is looped.
In this mode the TS350 cannot clear the incoming call, which must be cleared by the remote tester. This is to avoid tampering when the TS350 is left unattended.

27

None: No incoming calls are looped. In this mode all calls are manually answered. Voice calls operate normally.

ManPRBS: If an incoming call compatible with the selected bearer in the **Bearer** menu is received the TS350 will ring. When you answer the call with the [♪] key, the TS350 sends its own PRBS pattern as selected in the **Pattern** menu. This mode allows the transmit and receive directions to be independently tested for errors end to end.

After answering the call you are presented with the test results screen.

In this mode you can wait for the remote tester to finish the test or clear the call from your TS350.

```
BER Test            14:20 ▯
─────────────────────────
C=Stop *=Reset #=Err
Return to menu
E:0 ES:0 SES:0
Time left  00:00:59
─────────────────────────
L2 USR RR_C  TEI=74
B2 DATA IN PRBS
```

AutoPRBS: If an incoming call compatible with the selected bearer in the **Bearer** menu is received the TS350 automatically answers the call and sends its own internally generated PRBS pattern as selected in the **Pattern** menu. This mode allows the transmit and receive directions to be independently tested for errors end to end. In this mode the TS350 may be left unattended.

After The TS350 auto answers the call you are presented with the test results screen, which shows the errors, received in the incoming test pattern from the remote tester.

The TS350 cannot clear the incoming call, which must be cleared by the remote tester. This is to avoid tampering when the TS350 is left unattended.

Note: Scroll down the menu pressing the ▼ *key to highlight Auto PRBS for selection.*

Pattern

Selects the PRBS test pattern to be used for both an outgoing BERT and an incoming BERT.

```
┌─────────────────────────────┐
│  BER Test        14:20  ▮    │
│  2⁹-1                    1    │
│  2¹¹-1  *                2    │
│  2¹⁵-1  inv             3    │
│                              │
│  ─────────────────────       │
│                              │
└─────────────────────────────┘
```

2^{11}-1 is the default pattern for basic rate individual B channel ISDN circuits. The 2^9-1 and 2^{15}-1 **inv**erted patterns provide flexibility when interworking with the other test equipment. For example when doing end to end BERTs with other test equipment.

Test Time

Selects the test time duration for an outgoing BERT.

```
┌─────────────────────────────┐
│  BER Test        14:20  ▮    │
│  1 Min  *                1    │
│  15 Min                  2    │
│  User                    3    │
│  Cont                    4    │
│                              │
└─────────────────────────────┘
```

1 Min: 1 minute is the default test time for a line commissioning test.

15 Min: 15 minute test time option.

User: Allows you to set your own standard test time by entering your selected time in the sub menu:

```
BER Test          14:20
C=Abort
Accept Value
Time-    hh mm
          01:30
```

To enter the test time enter the full time including leading zeros with the hours first e.g. press 0; then 1; then 3; then 0; to give the test time of 1 hour and 30 minutes

G.821 Results

Presents the full G.821 test results of the last BERT test as shown in the example below:

```
Test Results      14:20
Errors: 3
Test time: 60
BER: 7.8 E-07
UAT: 0=00.000%
```

▼

```
Test Results      14:20
UAT: 0=00.000%
 ES: 3=05.000%
SES: 0=00.000%
DM: 0=00.000%
```

Test Thresholds

Sets the error level that will be treated as a BERT failure. You can either set the error level as a number of bit errors, or to be G.821 values. If you select G.821 values, the occurrence of any one of the three values during the test will result in a test failure.
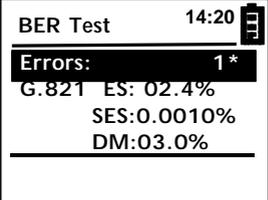
```
BER Test        14:20 ▊
Errors:            1*
 G.821  ES: 02.4%
        SES:0.0010%
        DM:03.0%
```

To set a threshold value, highlight the menu item you require to set and then enter the digits with the most significant digit first. To enter **Errors,** enter the number of errors. E.g. for an error failure threshold of 1, enter 1; for an error failure threshold of 20 enter 2 then 0. To enter G.821 criteria e.g. to set ES to 02.4% enter 0; then 2, then 4.

Speech Call

To make a speech call, select Speech from the **Test Menu**.
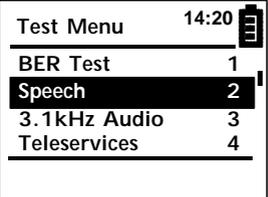
```
Test Menu       14:20 ▊
BER Test           1
Speech             2
3.1kHz Audio       3
Teleservices       4
```

Enter the B channel number you want to call on. The options are:

B1 or B2: exclusive in the Setup message
Bx: any channel in the Setup message

Note: Some iSPBXs will only allow a Setup message with any channel specified.

```
Speech Call        14:20
─────────────────────────
Enter B ch#: 1
Bx
Dial: Overlap

─────────────────────────
```
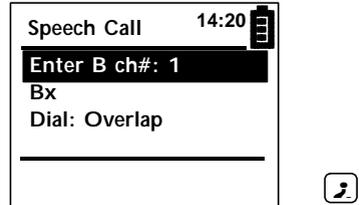
Key in the digits of the number you wish to call. When **Dial : Overlap** is set, the digits are signalled individually in Information messages.

```
Speech Call        14:20
─────────────────────────
 Enter Number:
 01633123123


L2 USR RR_C  TEI=0
L3 USR INFO
```

When the called number connects, you will be presented with the call in progress screen:

```
Speech Call        14:20
─────────────────────────
 Called Number:
 01633123123
 C=Clear, ▲=KEYPAD
 Return to Menu
L2 USR RR_C  TEI=0
B1 SPEECH OUT
```
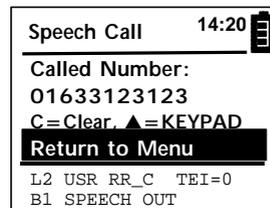
Pressing the [☎] key takes you back into the **Test Menu**. This feature is useful to talk a colleague at a remote site whilst making an end to end or self call BERT.

During a call DTMF tones can be sent end to end when the number keys, ⁎ and # are pressed. This is useful when using remote test equipment.

If the ▲ key is pressed then KEYPAD information messages are sent when number keys number keys, ⁎ and # are pressed. This is useful when invoking or suspending supplementary services.

Dialling Mode

Speech (and 3.1kHz) bearer calls can be made using either overlap or en bloc number signalling. Overlap dialling send number Information messages for each digit dialled, whilst with en bloc dialling the entire number is sent in the Called Party Number information element in the outgoing Setup message.

To select En Bloc dialling, from the **Speech Call** menu, scroll down and select **Dial: Overlap** by pressing the ♪ key to toggle the dialling mode to En Bloc.

Speech Call	14:20
Enter B ch#: 1	
Bx	
Dial: Overlap	

▼

♪

Speech Call	14:20
Enter B ch#: 1	
Bx	
Dial: En-Bloc	
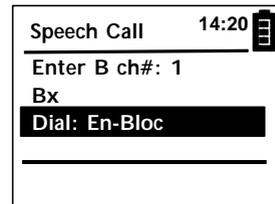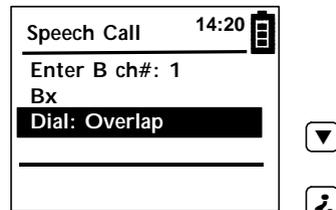
3.1kHz Audio Call

To make a 3.1kHz bearer voice call, select 3.1kHz from the **Test Menu**.

```
Test Menu        14:20
BER Test           1
Speech             2
3.1kHz Audio       3
Teleservices       4
```
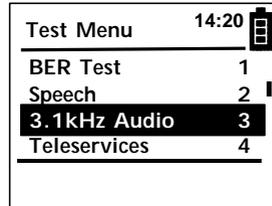
Enter the B channel number you want to call on and press the
🎵 key. The options are:

B1 or B2: exclusive in the Setup message
Bx: any channel in the Setup message

Note: Some iSPBXs will only allow a Setup message with any channel specified.

```
3.1kHz Call      14:20
Enter B ch#: 1
Bx
Dial: Overlap
```
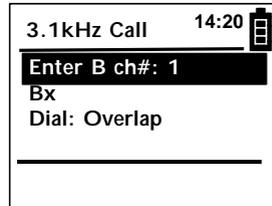
Note: The dialling mode may be selected to be either En-Bloc or Overlap by scrolling down to highlight **Dial: En-Bloc** *and selecting your choice of dialling mode in the same way as for a Speech call. Note that the default dialling mode for 3.1kHz Audio is En-Bloc.*

Key in the digits of the number you wish to call and press 🎵. When **Dial : En-Bloc** is set, the digits are signalled in the Setup message.

```
3.1kHz Call        14:20
Enter Number:
01633123123



L2 USR RR_C   TEI=0
L3 USR SETUP
```

When the called number connects, you will be presented with the call in progress screen:

```
3.1kHz Audio      14:20
Called Number:
01633123123
C=Clear, ▲=KEYPAD
Return to Menu
L2 USR RR_C   TEI=0
B1 SPEECH OUT
```
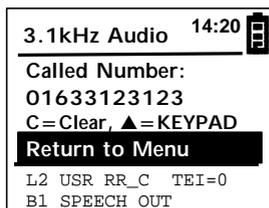
Pressing the ⌜♪⌝ key takes you back into the **Test Menu**. This feature is useful to talk a colleague at a remote site whilst making a BERT.

During a call DTMF tones can be sent end to end when the number keys,⌜*⌝ and⌜#⌝ are pressed. This is useful when using remote test equipment.

If the ⌜▲⌝ key is pressed then KEYPAD information messages are sent when number keys number keys, ⌜*⌝ and ⌜#⌝ are pressed. This is useful when invoking or suspending supplementary services.

Receiving a Voice Call

When your TS350 receives a compatible incoming Setup message (incoming call) the piezo sounder will ring and you will be prompted with the screen:
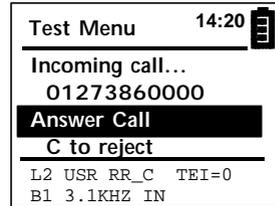
```
Test Menu        14:20 ▐
Incoming call...
  01273860000
Answer Call
  C to reject
L2 USR RR_C  TEI=0
B1 3.1KHZ IN
```
[♪]

To answer the call press the [♪] key and you will be able to talk to the calling party. You will then be presented with the call in progress screen:

```
Test Menu        14:20 ▐
Caller Number:
  01273860000
C=Clear,▲=KEYPAD
Return to Menu
L2 USR RR_C  TEI=74
B1 3.1KHZ IN
```
[C]
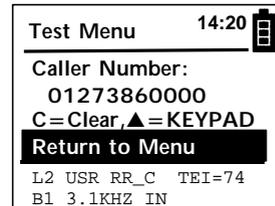
If you wish to end the call, press the [C] key or just wait for the calling party to clear the call. After call clearing you will be returned to the TS350 **Test Menu**.

To make a second call, for example to conduct a BERT, press the [♪] key to return to the Test Menu and select the BER Test option. This feature is useful if you want to make an end to end BERT whilst discussing results with a colleague.

Teleservice Tests

The TS350 can automatically check for Teleservice HLC (Higher Layer Compatibility) support on the line by making a series of self calls to the number of the line under test and inspecting the incoming network Setup message for the appropriate HLC information element. This test is performed without connecting the calls and so no customer call charges are incurred.

```
Test Menu        14:20 ▐
BER Test            1
Speech              2  ▌
3 1kHz Audio        3
Teleservices        4
L2 USR INFO   TEI=74
L3 USR SETUP
```

To select the Teleservices test suite, scroll down to highlight **Teleservices** in the Test Menu and press ⟨♪⟩ **.**

The **Teleservices** test menu is then presented as shown below:

```
Teleservices     14:20 ▐
Automatic           1
Telephony           2
7kHz                3
Fax G2/3            4
```

To view all the test options scroll down through the menu:

```
Teleservices     14:20 ▐
Fax G4 C1:          5
Fax G4 C2/3:        6  ▌
Mixed Mode:         7
Teletex F220:       8
```

```
Teleservices        14:20
Teletex F200:          9
Videotex:             01
Telex F60:            02
MHS X400:             03
```

▼

```
Teleservices        14:20
MHS X400:             03
OSI X200:             04
Maintenance:          05
Management:           06
```

Teleservices can be tested individually by highlighting the Teleservice to be tested and pressing 📞 , or all services can be tested automatically.

To conduct an automatic Teleservices test highlight and select **Automatic** by pressing 📞.

You will next be prompted to enter the B channel number on which to make the outgoing call. The default is B1, or enter the channel number of your choice. The press 📞 .

```
Teleservices        14:20
Enter B ch#: 1
Bx
```

When prompted to enter **Own number:**, enter the number of the ISDN line under test and press to start the automatic test sequence.

```
Teleservices      14:20
 Own Number:
 01633123456
```

During the test you are presented with test progress messages:

```
Teleservices      14:20

Testing…
    Telephony
```

On completion of the test you will see a Normal call clearing message and be presented with the test results, which you can scroll down through. If a Teleservice has been tested as supported then the item is shown with a ✓. If it is not supported then it is shown with a ✘.

```
Teleservices      14:20
Automatic          1
Telephony: ✓       2
7kHz: ✘            3
Fax G2/3: ✓        4
```

```
Teleservices      14:20
Fax G4 C1: ✓       5
Fax G4 C2/3: ✓     6
Mixed Mode: ✓      7
Teletex F220: ✓    8
```

39

```
┌─────────────────────────┐
│ Teleservices    14:20 ▯ │
│ Teletex F200: ✓    9    │
│ Videotex: ✓       01    │
│ Telex F60: ✓      02    │
│ MHS X400: ✓       03    │
│                         │
└─────────────────────────┘   ▼
```

```
┌─────────────────────────┐
│ Teleservices    14:20 ▯ │
│ MHS X400: ✓       03    │
│ OSI X200: ✓       04    │
│ Maintenance: ✓    05    │
│ Management: ✓     06    │
│                         │
└─────────────────────────┘   ▼
```

To conduct a single Teleservice test highlight and select the Teleservice to be tested

```
┌─────────────────────────┐
│ Teleservices    14:20 ▯ │
│ Fax G4 C1:         5    │
│ Fax G4 C2/3:       6    │
│ Mixed Mode:        7    │
│ Teletex F220:      8    │
│                         │
└─────────────────────────┘   📞
```

Enter **Own Number** and press 📞 .

```
┌─────────────────────────┐
│ Teleservices    14:20 ▯ │
│ Own Number:             │
│ 01633123456             │
│                         │
│                         │
│ ALL CHANNELS IDLE       │
└─────────────────────────┘   📞
```

You are presented with the test progress message and the result upon completion.

```
Teleservices        14:20 🔋

Testing...
    Teletex F220
    ─────────────
```

```
Teleservices        14:20 🔋
Fax G4 C1:          5
Fax G4 C2/3:        6
Mixed Mode:         7
Teletex F220: ✓     8
```
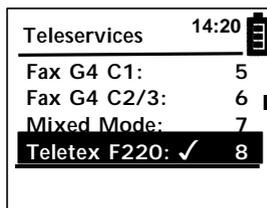
Supplementary Service Tests

The TS350 can automatically check for Supplementary Service support on the line by making a series of self calls to the number of the line under test and inspecting the incoming network Setup message for the appropriate information elements. This test is performed without connecting the calls, and so customer call charges are minimised.

```
Test Menu           14:20 🔋
Speech              2
3.1kHz Audio        3
Teleservices        4
Supplementary       5
```

▼

☎
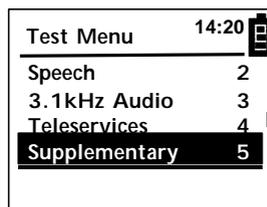
To select the supplementary services test suite, scroll down to highlight **Supplementary** in the Test Menu and press the ⏎ key.

The **Supplementary** services test menu is then presented as shown below:

```
┌─────────────────────────┐
│ Suppl. Serv.   14:20 ▐  │
│ Automatic          1    │
│ DDI/MSN:                │
│ 2                       │
│ SUB:               3    │
│ CLIP:              4    │
└─────────────────────────┘         ▼
```

To view all the test options scroll down through the menu:

```
┌─────────────────────────┐
│ Suppl. Serv.   14:20 ▐  │
│ SUB:               3    │
│ CLIP:              4    │
│ CLIR:              5    │
│ TP:                6    │
│                         │
└─────────────────────────┘
```

DDI/MSN: the TS350 makes an outgoing self call and inspects the incoming network Setup message for a Called Party Number information element. If this is present then the line supports DDI (Direct Dialling IN).

SUB: the TS350 makes an outgoing self call containing a sub address information element in the outgoing Setup message with Sub address 'Harris', and inspects the incoming network Setup message for the sub address information element. If its is present in the network Setup message, then the line supports sub addressing. The Sub address test uses the sub address type set in the Setup menu: either **NSAP** or **User**.

42

CLIP: the TS350 makes an outgoing self call and inspects the incoming network Setup message for a Calling Party Number information element. If this is present with valid number contents, then the line supports CLIP (Calling Line Identity Presentation).

CLIR: the TS350 makes an outgoing self call with the Calling Party Number information element set to restricted and inspects the incoming network Setup message. If the Calling Party Number information element is set to restricted, then the line supports CLIR (Calling Party Number Identity Restricted).

TP: the TS350 makes an outgoing self call and automatically suspends and resumes the call when the **Automatic** test sequence is selected. If the sequence occurs with the correct network responses then TP (Terminal Portability) is supported on the line.

The Supplementary services listed in the menu can be tested individually by highlighting the Supplementary service to be tested and pressing the 📞 key , or you can test all the supplementary services listed in the menu automatically.

Automatic

To conduct an automatic Supplementary services test highlight and select **Automatic** by pressing the 📞 key.

You will next be prompted to enter the B channel number on which you will make the outgoing call. The default is 1, or enter the channel number of your choice. Then press 📞.
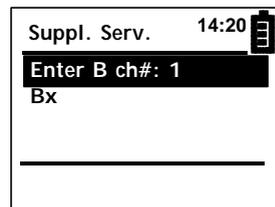
```
Suppl. Serv.    14:20 ▮
Enter B ch#: 1
Bx

_____
```

📞

When prompted to enter **Own number:**, enter the number of the ISDN line under test and press ⌨ to start the automatic test sequence.

```
┌────────────────────────┐
│ Suppl. Serv.    14:20 ▯│
│ ─────────────────────  │
│  Own Number:           │
│ █01633123456█          │
│                        │
│                        │
│ ─────────────────────  │
│                        │
└────────────────────────┘
```

⌨

During the test you are presented with test progress messages:

```
┌────────────────────────┐
│ Suppl. Serv.    14:20 ▯│
│ ─────────────────────  │
│                        │
│  Testing...            │
│     DDI                │
│ ─────────────────────  │
│                        │
└────────────────────────┘
```

On completion of the test you will see a Normal call clearing message and be presented with the test results, which you can scroll down through. If a Teleservice has been tested as supported then the item is shown with a ✓. If it is not supported then it is shown with a ✖.

```
┌────────────────────────┐
│ Suppl. Serv.    14:20 ▯│
│ ─────────────────────  │
│ █Automatic        1█   │
│  DDI: ✓     2          │
│  SUB: ✖          3     │
│  CLIP: ✓         4     │
│ ─────────────────────  │
└────────────────────────┘
```

▼

```
                      Suppl. Serv.    14:20
                      SUB: ✖            3
                      CLIP: ✓           4
                      CLIR: ✓           5
                      TP: ✓             6
```

Manual DDI/MSN/SUB/CLIP/CLIR

To conduct a manual Supplementary service test highlight and select
the service to be tested

```
                      Suppl. Serv.    14:20
                      Automatic         1
                      DDI:      2
                      SUB:              3
                      CLIP:             4
```

Enter the B channel number on which you will make the outgoing
call. Then press 📞.

```
                      Suppl. Serv.    14:20
                      Enter B ch#: 1
                      Bx
```

Enter **Own Number** and press 📞.

```
                      Suppl. Serv.    14:20
                      Own Number:
                      01633123456
```

45

You are presented with the test progress message and the result upon completion.

```
Suppl. Serv.        14:20 ▯

   Testing…
      CLIP

_____
```

```
Suppl. Serv.        14:20 ▯
Automatic           1
DDI/MSN:            2  ▮
SUB:                3
CLIP: ✓             4
```
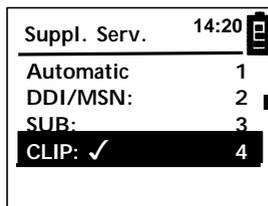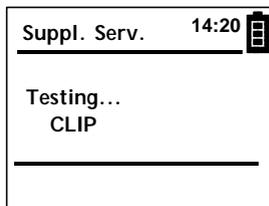
Manual TP

To test TP manually, select TP from the menu:

```
Suppl. Serv.        14:20 ▯
SUB:                3
CLIP:               4
CLIR:               5  ▮
TP:                 6
```

[☎]
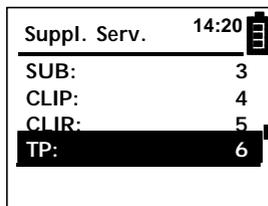
Enter the number of another voice terminal e.g. the speaking clock.

```
Suppl. Serv.        14:20 ▯
Own Number:
123

_____
B1 IDLE
```

[☎]

46
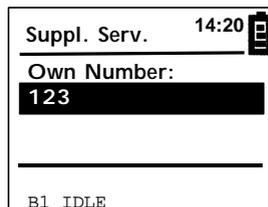
When the call is answered select the Suspend ID (or enter your own ID) to suspend the call:

```
┌─────────────────────────┐
│ Suppl. Serv.    14:20 ▐█│
│─────────────────────────│
│ Suspend ID:             │
│ 12                      │
│                         │
│─────────────────────────│
│ B1 SPEECH OUT           │
└─────────────────────────┘
```

Note: After you have successfully suspended the call, you can physically disconnect the TS350 from the S bus and then reconnect within 3 minutes.

To resume the call, select the Resume ID:

```
┌─────────────────────────┐
│ Suppl. Serv.    14:20 ▐█│
│─────────────────────────│
│ Resume ID:              │
│ 12                      │
│                         │
│─────────────────────────│
│ B1 SPEECH OUT           │
└─────────────────────────┘
```

To end the test, clear the call:

```
┌─────────────────────────┐
│ Suppl. Serv.    14:20 ▐█│
│─────────────────────────│
│                         │
│ C = Clear Call          │
│                         │
│─────────────────────────│
│ B1 SPEECH OUT           │
└─────────────────────────┘
```

If the correct network responses are received then the test will be shown as passed. If the network rejects the Suspend message, then the TP test will be shown as failed.

Voltages

To select the Voltages menu, scroll down to highlight **Voltages** in the Test Menu and select by pressing the ⎣♪⎦ key.

```
Test Menu          14:20 ▊
3.1kHz Audio         3
Teleservices         4
Supplementary        5
Voltages             6
```

The TS350 measures the battery, DC supply and the ISDN interface voltages. This feature is useful to ensure that the network voltages are within specification. If not within the limits, then you may have a network or NT1 fault.

Note: To see the PS2 scroll down.

```
Voltages           14:20 ▊
Battery: 2.60v
DC: 0.0v
PS1: 40v(R)
PS2: 0.0v
```

```
Voltages           14:20 ▊
DC: 0.0V
PS1: 40V(R)
PS2: 0.0V
U: 0.0V
```

Battery: The NiMH batteries typically operate in the range 2.2 to 2.7volts. You will have up to 7 hours continuous use when the battery has been charged to 2.7 volts (off charge).

DC: The voltage of the mains plug top DC power supply when connected. Typically 12 to 14 volts.

PS1: Power Source 1. The phantom power feed voltage across the transmit and receive pair of the S interface. N designates Normal power in the range 24 to 42 volts with power of 1 watt. R designates restricted or emergency power (indicated by reverse polarity) in the range 32 to 42 volts with power of 420mW.

PS2: Power Source 2 (optional on an NT1) on pins 7 and 8 of the S interface RJ45 connector. Normal (N) power is a minimum 7 watts in the range 32 to 42 volts. Restricted (R) power is a minimum of 2 watts in the range 32 to 42 volts.

U: The voltage at the U two wire interface. Typically 90 volts for a powered line feed.

Recorded Data

To select the **Recorded Data** menu scroll down the Test Menu and select with the 🎵 key.

Test Menu	14:20
Teleservices	4
Supplementary	5
Voltages	6
Recorded Data	**7**

🎵

Recorded Data	14:20
Trace L1/L2/L3	**1**
Number Log	2

49

After selecting one of the **Recorded Data** menu items you can use the keys below to move through the listings

▼ Short press to scroll down one line. Long press (>1 sec) to page down 6 lines. Press and hold continuously pages down 6 lines every second.

▲ Short press to scroll up one line. Long press (>1 sec) to page up 6 lines. Press and hold continuously pages up 6 lines every second.

[1] Press to go to the first item in the log.

[0] Number log: press to go to the last item in the log
Trace: press to go to last item and AUTO scroll.

[*] Press to clear the log.

[C] Press to exit the Test Results and return to the **Test Menu.**

Trace L1/L2/L3

To display **Trace L1/L2/L3** select the item from the Recorded Data menu.
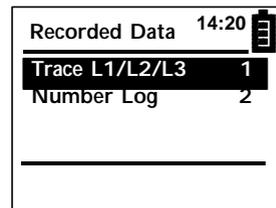
This screen shows a simple decode of the D channel protocol captured during test calls. The frame types and message types can

be filtered to display the options selected in the **Setup** menu item **Trace** as shown below:

- Layer 1 INFO states
- Layer 2 frame types
- Layer 2 RR frames
- Layer 3 messages
- 'Display' Information Elements

The trace buffer will store up to 200 lines of decode. An example of a captured trace is shown below.

```
Trace                 14:20
001 U 00 000 SABME C
002 N 00 000 UA R
003 U 00 000 RR C
004 N 00 000 RR R
005 U 00 000 I C
006 U 001 B2 SETUP
▲ ▼ Scroll Up/Down
1=TOP 0=AUTO *=CLEAR
```

The trace format is shown below:

Layer 1 INFO states:
```
Buffer
Line#     STATE
001 U INFO3
      ↑
    U=User/terminal side
    N=Network side
```

Layer 2 frames:
```
Buffer
Line#    SAPI   TEI    Frame type
001 U 00   000    SABME
```

Layer 3 messages:

```
Buffer   Call
Line#    Ref  Channel Message type
006 U 001   B1   SETUP
```

For a listing of all Layer 1 Alarm states, Layer 2 frame types and Layer 3 message types see Appendix   .

Number Log

To display **Number Log** select the item from the Recorded Data menu.

```
┌─────────────────────────────┐
│ Recorded Data   14:20 ▐█    │
│ ──────────────────────────  │
│ Trace L1/L2/L3      1       │
│ ▐ Number Log        2 ▌     │
│                             │
│ ──────────────────────────  │
└─────────────────────────────┘
```
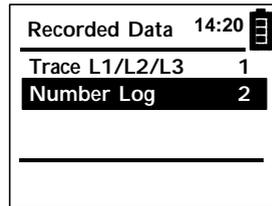
This screen shows a log of all outgoing and incoming **Calling** Party Numbers (CLI) and **Called** Party Numbers (CPN). An example of a Number log is shown below.

```
┌─────────────────────────────┐
│ Number Log      14:20 ▐█    │
│ ──────────────────────────  │
│ 01 B2 O/G CALLING NO        │
│    012911234567             │
│    B15 O/G CALLED NO        │
│    012916667777             │
│ 02 B1 I/C CALLING NO        │
│    016337654321             │
│ ▲ ▼ Scroll Up/Down          │
│ 1=TOP 0=END *=CLEAR         │
└─────────────────────────────┘
```
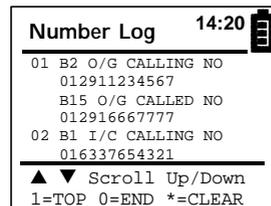
Setup

To select the Setup menu, scroll down to highlight **Setup** in the Test Menu and select by pressing the 🕻 key.

```
┌─────────────────────────────┐
│ Test Menu       14:20 ▐█    │
│ ──────────────────────────  │
│ Supplementary       5       │
│ Voltages            6       │
│ Recorded Data       7       │
│ ▐ Setup             8 ▌     │
└─────────────────────────────┘
```
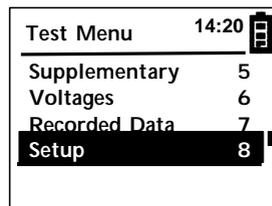
The Setup menu is shown below:

Setup	14:20
TEI: Auto	1
Language:English	2
Term: 100ohm	3
Set Date & Time	**4**

▼

Setup	14:20
Set Date & Time	4
Codec: A Law	5
Sub Address:NSAP	6
Terminal No	**7**

▼

Setup	14:20
Terminal No	7
Set Default:	8
Contrast	9
Trace	**01**
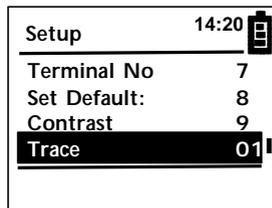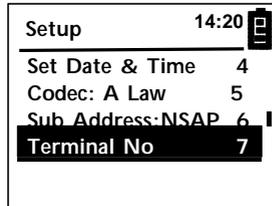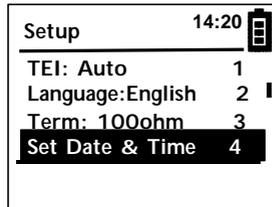
To select a menu item, scroll down to highlight the item and select by pressing the ♪ key to display the sub menu.

The current selection is shown with a * next to the item in the sub menu. To exit a sub menu without making a new setting, press the C key.

TEI

This menu allows you to set an automatic TEI assignment procedure as used on a Point to Multipoint (PMP) S bus, or to select a Fixed TEI as used for example by iSPBXs.

Select the TEI sub menu by highlighting TEI in the Setup menu and pressing the ♪ key.

```
 TEI              14:20  ▐
 Auto: *              1
 Fixed: 0             2


 ────────────────────
```
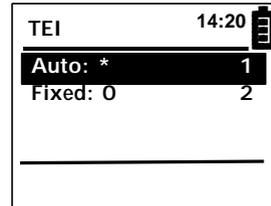
To select automatic TEI assignment (PMP) highlight **Auto** and select by pressing the ♪ key. You will be returned to the Setup menu and see **TEI: Auto** displayed.

To enter a Fixed TEI value, scroll down to highlight **Fixed,** enter the TEI value required in the range 0 to 63, and save by pressing the key. You will be returned to the Setup menu a ♪ see **TEI: Fixed 0** displayed with the value you entered (in this example 0).

Language

The menu structure can be displayed in 4 languages. To select the language of your choice, select the **Language** sub menu, scroll to highlight the language of your choice and press the ♪ key. You will then be returned to the **Setup** menu with your choice of language shown.
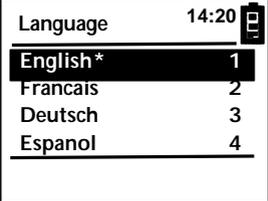
Language	14:20
English*	1
Francais	2
Deutsch	3
Espanol	4

Term

The S interface transmit and receive pairs can be terminated with a 100ohm resistor across each pair, or left high impedance - Hi Z. If the TS350 is the only item on the S bus then use the 100 ohm termination setting. If the S bus is already terminated by another terminal, then use the Hi Z setting.

To change the termination setting, select **S Term** from the **Setup** menu.
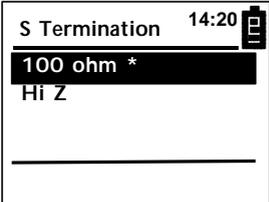
S Termination	14:20
100 ohm *	
Hi Z	

Scroll down to highlight your choice and press the ⌨ key. You will then be returned to the Setup menu with your selection shown.

Set Date & Time

The TS350 has a real time clock, which is used to date and timestamp the Genius compatible binary trace output on the RS232 port, and to display the time in all menus.

55

Scroll down to **Set Time and Date** in the **Setup** menu, and select by pressing the 🎵 key.

```
┌──────────────────────────┐
│ Set Date        14:20  ▮ │
├──────────────────────────┤
│  * = Time                │
│ Date-    dd              │
│          16/ 02/ 01      │
│ Save Date & Time         │
│                          │
│                          │
└──────────────────────────┘
```
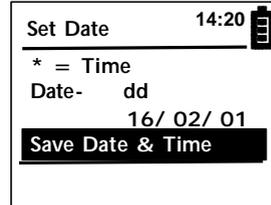
To set the date, enter the current date in the format shown on the screen. e.g. to set the date shown enter 1, then 6, then 0, then 2, then 0 then 1: i.e. 16th February 2001.

To set the time press the ⁎ key to display the screen shown below:

```
┌──────────────────────────┐
│ Set Time        14:20  ▮ │
├──────────────────────────┤
│  * = Date                │
│ Time-    hh              │
│          11: 20: 00      │
│ Save Date & Time         │
│                          │
│                          │
└──────────────────────────┘
```

To set the time, enter the current time in the format shown on the screen in hours, minutes and seconds. e.g. to set the time shown enter 1, then 1, then 2, then 0, then 0, then 0.

i.e.
```
hh mm ss
11 20 00
```

Coding Law

The TS350 will support either the A law coding algorithm as used in Europe or the μ (mu) law coding algorithm as used in the USA and Japan.

To set the Codec law, scroll down to select **Codec** in the Setup menu and press the 🎵 key.

```
┌─────────────────────────────┐
│ Codec Law        14:20  ▐   │
│ ███████████████████████████ │
│ A Law *                  1  │
│ u Law                    2  │
│                             │
│                             │
│ ─────────────────────────── │
│                             │
└─────────────────────────────┘
```
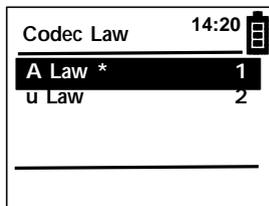
Scroll to highlight the codec law required and select by pressing the key. You will be return🎵d to the Setup menu with the Codec Law selected shown.

Sub Address

The TS350 can send and recognise two types of sub address as defined in the ETSI standards: User and NSAP.

Scroll down to highlight **Sub Address** in the **Setup** menu and select by pressing the 🎵 key.

```
┌─────────────────────────────┐
│ Sub Address      14:20  ▐   │
│ ███████████████████████████ │
│ User                     1  │
│ NSAP *                   2  │
│                             │
│                             │
│ ─────────────────────────── │
│                             │
└─────────────────────────────┘
```
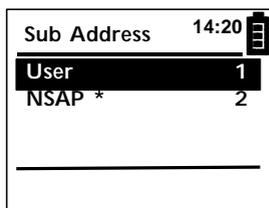
Scroll to highlight the Sub Address type required and press the 🎵 key. You will be returned to the Setup menu with the Sub Address type selected shown.

Terminal No

If you enter a Terminal No, the TS350 will send this number in Setup messages as the Calling Party Number information element and

respond only to calls that have a least significant digits match of the terminal number in a Called Party Number information element in a Network Setup message. If there is no Called Party Number IE in the Network Setup message, or no entry in Terminal No, then the TS350 will respond to all Network Setup messages.

Scroll down to highlight Terminal No in the Setup menu and press the 🎵 key.

You are prompted to enter the number of the Terminal.

```
┌─────────────────────────────┐
│ Terminal No      14:20  ▤   │
│ ─────────────────────────── │
│ Terminal Number:            │
│ ███████████████████████████ │
│ 01291654321                 │
│                             │
│                             │
│ L2 USR RR_C   TEI=0         │
└─────────────────────────────┘
```

Enter the number you wish to assign to the TS350 and press the 🎵 key to save the number. The number is saved and you are returned to the Setup menu. This number is cleared when the unit is switched off.

Set Default

This menu item will reset all the TS350 defaults setup parameters. Scroll down to highlight Set Default and select by pressing the 🎵 key. When the default values have been selected this is denoted with a * character:

```
┌─────────────────────────────┐
│ Setup            14:20  ▤   │
│ ─────────────────────────── │
│ Codec: A Law        5       │
│ Sub Address:NSAP    6       │
│ Terminal No         7       │
│ Set Default *       8       │
│                             │
└─────────────────────────────┘
```

When you set a parameter to a non-default value, the * will be removed. All setup parameters (except Terminal No) are stored in non volatile memory and will be maintained even if the batteries are flat or removed.

Contrast

The LCD display contrast can be set after selecting the Contrast Setup menu item.

Pressing the [▲] key repeatedly will increase the contrast, and pressing the [▼] key repeatedly will decrease the contrast.

```
┌─────────────────────────────┐
│ Set Contrast    14:20 ▮     │
│ ─────────────────────────── │
│    Display Contrast         │
│  ▼Down           Up▲        │
│  |||||||||||                │
│                             │
│ L2 USR RR_C  TEI=0          │
└─────────────────────────────┘
```
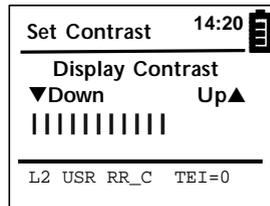
Trace

The internal trace buffer for Layer 1, 2 and 3 messages can be filtered.

Scroll down to highlight **Trace** in the Setup menu and select by pressing the [♪] key.

Each item can be selected as shown with a ✓ or deselected as shown with a X by scrolling to highlight the item and pressing the [♪] key to toggle the item. When you have finished setting the filters as you require, then press the [C] key to exit the menu.

```
┌─────────────────────────────┐
│ Trace           14:20 ▮     │
│ ─────────────────────────── │
│ Layer 1: X                  │
│ Layer 2: ✓                  │
│ L2-RR: X                    │
│ ███Layer 3: ✓███████████    │
└─────────────────────────────┘
```

59
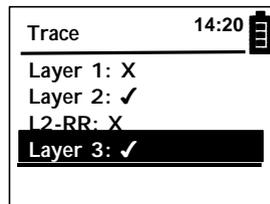
User Messages

A full listing of user messages is described in the Appendix

Layer 1 messages

The TS350 displays the INFO states as they are received in the top line of the lower section of the screen.
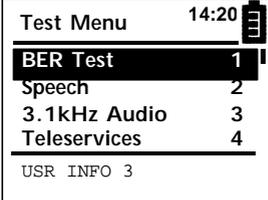
```
Test Menu        14:20
BER Test           1
Speech             2
3.1kHz Audio       3
Teleservices       4
USR INFO 3
```

When Layer 1 activation is complete the TS350 indicates this by either the S or U LED flashing green depending upon the interface that is connected.

If the TS350 is unable to activate layer 1 at either the S or U interface, then the message:

```
Layer 1 activation failure
```

will be displayed and the S or U LED will flash red.
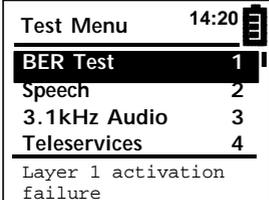
```
Test Menu        14:20
BER Test           1
Speech             2
3.1kHz Audio       3
Teleservices       4
Layer 1 activation
failure
```

Layer 2 messages

When Layer 1 is activated, the TS350 will display all Layer 2 frames sent or received together with the TEI value in the top line of the lower section of the screen.

```
┌─────────────────────────────┐
│ Test Menu        14:20 ▐█▌  │
├─────────────────────────────┤
│ BER Test            1       │
│ Speech              2  ▮    │
│ 3.1kHz Audio        3       │
│ ▐Teleservices       4▌      │
├─────────────────────────────┤
│ L2 USR INFO  TEI=0          │
│ L3 USR SETUP                │
└─────────────────────────────┘
```
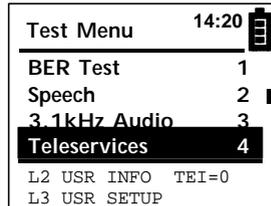
If a Layer 2 error has occurred an error message will be displayed in the top line of the lower section of the screen. e.g.

```
┌─────────────────────────────┐
│ Test Menu        14:20 ▐█▌  │
├─────────────────────────────┤
│ BER Test            1       │
│ Speech              2  ▮    │
│ 3.1kHz Audio        3       │
│ ▐Teleservices       4▌      │
├─────────────────────────────┤
│ L2SABME RETRANSMISSION      │
└─────────────────────────────┘
```
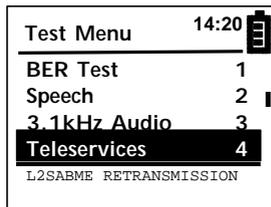
indicates that the TS350 has failed to get a network response to 4 transmissions of the SABME frame.

Layer 3 Messages

The TS350 will display all Layer 3 messages sent or received in the bottom line of the lower section of the screen wherever you are in the menu structure with the exception of the **Trace** screen.

```
┌─────────────────────────────┐
│ 3.1kHz Audio     14:20 ▐█▌  │
├─────────────────────────────┤
│ Enter Number:               │
│ ▐01633123123             ▌  │
│                             │
│                             │
├─────────────────────────────┤
│ L2 I_C   TEI=0              │
│ L3 USR SETUP                │
└─────────────────────────────┘
```

61

If the TS350 does not recognise a Layer 3 message an error message will be displayed on the bottom line of the lower section of the screen. e.g.

```
┌─────────────────────────┐
│ 3.1kHz Audio   14:20 ▐█▌ │
│ Enter Number:           │
│ ███████████████████████ │
│ 01633123123             │
│                         │
│ ─────────────────────── │
│ L3 unknown message      │
└─────────────────────────┘
```

B Channel Status

The TS350 shows the B channel status by displaying the call type on the bottom line of the lower section of the screen with scrolling messages.

```
┌─────────────────────────┐
│ Suppl. Serv.   14:20 ▐█▌ │
│ Own Number:             │
│ ███████████████████████ │
│ 123                     │
│                         │
│ ─────────────────────── │
│ B1 DATA OUT PRBS        │
└─────────────────────────┘
```
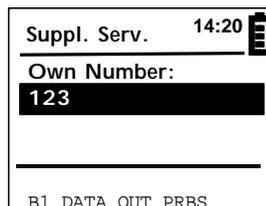
The display of Layer 3 messages takes priority over B channel status messages.

Clear Cause

When a call is cleared the TS350 displays the clear cause number and text description in the main section of the screen. e.g.

```
┌─────────────────────────┐
│ BER Test       14:20 ▐█▌ │
│ Cause = 16              │
│                         │
│ Normal call             │
│        clearing         │
│ ─────────────────────── │
│                         │
└─────────────────────────┘
```
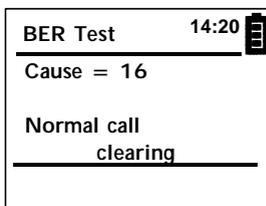
Passive Monitor

The TS350 Passive Monitor mode allows you to monitor Layer 1 and the D channel protocol at Layer 2 and Layer 3 in the TE to NT (User) and NT to TE (Net) directions on the S/T bus. In this mode the TS350 must be bridged onto the link between the NT and the TE which may be an ISPBX or multiplexer. You can do this by using appropriate adapters e.g. a dual outlet RJ45 adapter.
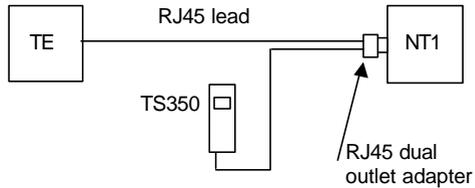
To activate the passive monitor mode, select **ISDN S-Monitor** from the Mode menu.

The **Monitor** screen shows a simple decode of the D channel protocol captured. The frame types and message types can be filtered to display the options selected in the **Test Menu** sub menu: **Setup, Trace** as shown below:

- Layer 1 INFO states
- Layer 2 frame types
- Layer 2 RR frames

63

- Layer 3 messages
- 'Display' Information Elements

The trace buffer will store up to 200 lines of decode. An example of a captured trace is shown below.

```
Monitor            14:20
001 U 00 000 SABME C
002 N 00 000 UA R
003 U 00 000 RR C
004 N 00 000 RR R
005 U 00 000 I C
006 U 001 B2 SETUP
▲ ▼  Scroll Up/Down
1=TOP 0=AUTO *=CLEAR
```

You can use the keys below to move through the monitor trace.

▼   Short press to scroll down one line. Long press (>1 sec) to page down 6 lines. Press and hold continuously pages down 6 lines every second.

▲   Short press to scroll up one line. Long press (>1 sec) to page up 6 lines. Press and hold continuously pages up 6 lines every second.

1   Press to go to the first item in the decode.

0   Press to go to the last item in the decode and AUTO scroll so that each new line of decode appears on the bottom of the display and earlier lines move up.

*   Press to clear the log.

C   Press to exit and return to the **Mode Menu.**

The trace format is:

Layer 1 Alarm states:

```
Buffer
Line#      INFO State
001 U  INFO3
      ↑
      U=User/terminal side
      N=Network side
```

Layer 2 frames:

```
Buffer
Line#    SAPI    TEI    Frame type
001 U 00   000   SABME
```

Layer 3 messages:

```
Buffer    Call
Line#    Ref  Channel Message type
006 U 001   B2   SETUP
```

For a listing of all Layer 1 alarm states, Layer 2 frame types and Layer 3 message types see the Appendix.

In addition Genius ISDN protocol analysis software can be used with the TS350 connected to a PC serial port using the RS232 lead.

PSTN Testing

The TS350 can test analogue PSTN lines and ports. This mode is very useful when testing combined ISDN S and analogue V5.1 combined NTs. The TS350 can also be used on regular analogue PSTN lines.

The TS350 has the following PSTN modes:

- Line monitor - "on hook"
- Talk mode - "off hook"
- DTMF or pulse/loop disconnect dialling
- Line voltage measurement showing polarity reversal

When in the **Mode** menu, inserting the PSTN line cord provided will auto select the PSTN menu if a line voltage is detected. If a voltage is not detected, or you also have the S interface connected, then you must manually select PSTN from the Mode menu.

Mode	14:20
ISDN S-TE	1
ISDN S-Monitor	2
ISDN U-TE	3
PSTN	**4**

PSTN	14:20
Monitor Mode	
DTMF	
Talk/Off hook	
Line = 48.0V	
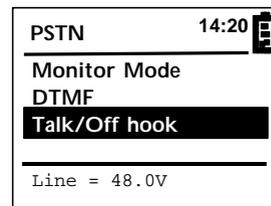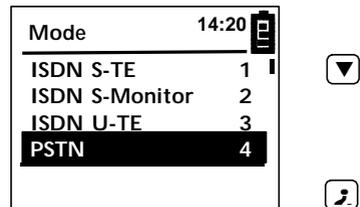
You can switch between DTMF and Loop Disconnect (Pulse) dialling by pressing the LD/MF [#] key.

In the on hook Monitor Mode you can listen in to the analogue line in high impedance monitor. The TS350 will not affect the use of other telephones on the line

To make a call, press the [♪] key to select the **Talk Mode** screen and then key in the called party number as you would with any test set. To clear or abort the call, press the [C] key to return to the **Monitor Mode** screen.

```
PSTN              14:20 ▊
Talk Mode
DTMF
0127386000
C to clear call
Line = 6.0V
```
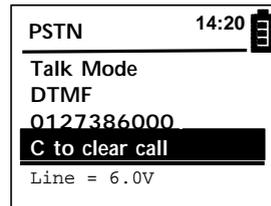
The bottom section of the screen always displays the line voltage and will show Reverse if the line polarity has been reversed. Normally pin1 on the RJ11 will be approximately ground potential and pin 4 will be connected to the exchange battery negative. The TS350 will operate normally if line polarity is reversed.

TS350 Firmware Upgrade

The TS350 firmware is stored in FLASH memory, which allows you to upgrade the firmware release from your PC. The latest firmware releases are available on the Harris web site or you may purchase feature upgrades on CD.

To upgrade your TS350 carry out the following steps.

Step 1
Download the upgrade file from the Harris web site and store it onto your hard drive in a directory of your choice. Or copy the upgrade executable file from the Upgrade CD. For example the path:

C:\Harris TS350\TS350Upgrade.exe

Note: Dependant upon the type of upgrade, you may need to get a security access code from your Harris representative to enable you to access the TS350 download area of the Harris web site.

Step 2
Use the serial cable provided to connect your TS350 RS232 port to the COM1 port on your PC.

Note: If COM1 is not available use another COM port.

Set the COM1 port baud rate to:

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

Step 3

Put your TS350 into upgrade mode by holding down the Ⓒ key and then simultaneously pressing the key to turn the TS350 on. You will hear the turn on beep but initially the screen will be blank.

Note: Whilst upgrading there should be no network connections to the TS350. Do not use the dc charger during the upgrade process and make sure your batteries are charged before starting.

Step 4

On your PC, in the Windows Start menu Run command dialogue box, enter the path and filename of the Upgrade executable file e.g.

C:\Harris TS350\TS350Upgrade.exe

and follow the on screen instructions. If you are using a TS350 Upgrade CD you may run the TS350Upgrade.exe executable file from your CDROM drive if you wish without copying the file to your hard drive.

Step 5

When the upgrade download is complete, switch off your TS350 and then turn it on again to load the new firmware. During the power on screen sequence you will see the new firmware release number displayed.

TS350® Basic Rate Euro ISDN Test Set

TS350 Specifications

Protocol

Layer 1 ETS300 012-1
Layer 2 ETS300 125
Layer 3 ETS300 102-1/2

BRI Interface

S 4 wire RJ45 socket. Pins 4,5 Receive, Pins 3, 6 Transmit (to NT)
U 2 wire RJ11 socket pins 2, 3

PSTN

RJ11 socket pins 1, 4.

Power

Typical operating power 230mW backlight off, 340mW backlight on
2 x 1.2volt NiMH batteries capacity 1200mAh
Typical battery operating time: 12 hours
12Vdc mains power supply 120mA max
dc plug 2.5mm inner, 5mm outer
Battery recharge time: 16 hours

Display

100 x 64 pixel LCD
Backlight power 110mW typical

RS232 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	TS350 transmit data
3	TS350 receive data
4	connected 1 and 6
5	signal ground
6	connected to 1 and 4
7	connected to pin 8
8	connected to pin 7
9	not connected

Weight

350gms

Environmental

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

Dimensions

Length: 205mm; width 78mm; depth 43mm

Safety

Complies with:
EN61010-1
EN41003
EN60950

CE

Complies with the EU Directives:
89/336/EC EMC
93/68/EC amendment
73/23/EC Low Voltage
92/31/EC Marking

APPENDIX

User messages

Layer 1 INFO States

INFO 0 No signal
INFO 1 Terminal activation request
INFO 2 Network activation request
INFO 3 Terminal activation indication
INFO 4 Network activation indication

Layer 1 Error message

Layer 1 activation failure

Layer 2 Frame types

I_R
I_C
DISC_R
DISC_C
DM_R
DM_C
FRMR_R
FRMR_C
REJ_R
REJ_C
RNR_C
RNR_R
RR_R
RR_C
SABM_R
SABM_C
SABME_R
SABME_C
UA_R
UA_C
UI_R

UI_C
SUPV_R
SUPV_C
 XID_R
XID_C
ID_ASSIGN
ID_DENIED
ID_CHK_REQ
ID_CHK_RESP
ID_REMOVE
ID_VERIFY

Layer 2 Error Messages

UNSOLICITED RESP. (A)
UNSOLICITED RESP. (B)
UNSOLICITED RESP. (C)
UNSOLICITED RESP. (D)
UNSOLICITED RESP. (E)
SABME RE-ESTABLISH.
SABME RE-TRANSMISSION
STATUS ENQ RE-TRANS
N(R) ERROR
FRMR RESPONSE
UNDEFINED CTRL. FIELD
I FIELD NOT PERMITTED
WRONG FRAME SIZE
N201 ERROR

Layer 3 Message Types

ALERTING
CALL_PROC
PROGRESS
CONNECT
CONN. ACK
SETUP
SETUP ACK

DISCONNECT
RELEASE
REL. COMP
STATUS INQ
INFO
STATUS
REST ACK
RESUME
RESUME ACK
RESUME REJ
SUSPEND
SUSP. ACK
SUSP. REJ
RETRIEVE
HOLD
HOLD ACK
REGISTER
NOTIFY
FACILITY
UNKNOWN

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

B Channel Status Messages

n = B channel number i.e. B1 or B2
Bn IDLE
Bn SPEECH OUT
Bn SPEECH IN
Bn 3.1KHZ OUT
Bn 3.1KHZ IN
Bn DATA OUT PRBS
Bn DATA IN PRBS
Bn DATA IN LOOPED
Bn DATA T&A OUT PRBS
Bn DATA T&A IN PRBS
Bn DATA T&A IN LOOPED

Abbreviations

BER	Bit Error Rate
BERT	Bit Error Rate Test
BRI	Basic Rate Interface
dc	direct current
IE	Information Element
ISDN	Integrated Service Digital Network
ISPBX	ISDN Private Branch Exchange
NT	Network Termination
PC	Personal Computer
PRBS	Pseudo-Random Binary Sequence
TE	Terminal Equipment