BERcut–E1

2 Mbit/s communications tester

Operating manual

Disclaimer
To allow for design and specifications improvements, the information in this manual is subject to change without notice.

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BERcut–E1 tester

1. FIELDS OF APPLICATION

1.1. “BERcut–E1” tester is an advanced analyser/generator for 2Mbit/s communications. It can be used for installation, bringing into service and maintenance of 2 Mbit/s transmission paths; and voice and data circuits; for analysis of the structure of PCM-systems primary data stream (ITU-T Recommendation G.704).

„BERcut-E1” connects to the primary data transfer interface (ITU-T Recommendation G.703) and can operate as generator/supervisor of different kinds of test signals in AMI and HDB-3 coding; or as monitor/analyser of signals of PCM systems (ITU-T Recommendation 0.162).

1.2. Normal environmental conditions:

– Operating temperature range: 5 to 40°C;
– Maximum relative humidity 90%, at temperature 25°C;
– Atmospheric pressure range: 70 to 106,7 kPa;
– Mains voltage 110 to 240V at frequencies 50 to 60 Hz (powered by the mains adapter).

Operational environmental conditions:

– Temperature: (+20±5)°C;
– Relative humidity: 40 to 80%, at temperature 25°C;
– Atmospheric pressure range: 84 to 104,7 KPa;
– Mains voltage 110 to 240V at frequencies 50 to 60 Hz (powering with the mains adapter).

2. TECHNICAL SPECIFICATIONS

2.1. Transmitter options

2.1.1. In the Data transfer monitor mode, the transmitter provides generation of the following test signals in AMI and HDB-3 coding:

a) Pseudo-random bit sequence (PRBS) with length 2^6–1, 2^9–1, 2^{11}–1, 2^{15}–1 и 2^{23}–1 (ITU-T Recommendation 0.151) and nominal transmission bit rate (2048000±6) bit/s;

b) PRBS with error insertion. Error insertion mode: singe, rate ($1x10^{-1}$ to $1x10^{-7}$);

2.1.2. In the PCM systems Monitor mode, transmitter provides generation of the AMI or HDB-3 coded signal (G.703) with the following states to be registered:

a) Loss of signal (LOS);

b) AIS;

c) Frame alarm;

d) Multiframe alarm;

e) RDI – Remote Defect Indication (ITU-T Recommendation G.706);

f) RMA – Remote Multiframe Alarm (ITU-T Recommendation G.732);

g) LSS – Loss of the sequence synchronization;

h) ARTF – transmission of an unstructured stream of interlacing 0 and 1;

i) Si, Sa4 – Sab – S–bits in the NFAS-word;

j) CAS 1, CAS 2, CAS 3, CAS 4 in the selected TS.

2.1.3. Pulse shape with the following parameters:

a) At the load impedance of (120±1,2)Ohm, nominal voltage of the pulse of any polarity is (3+0,3)V;

b) At the load impedance of (120±1,2)Ohm, peak voltage with no signal pulse is not more than 0,3 V;

c) Nominal pulse duration – (244±25)ns;

d) maximum pulse amplitude duration ratio for pulses of different polarity at half nominal amplitude level –0,95 to 1,05;

e) Regardless to voltage polarity, the pulse is displayed within the G.703 Mask.

2.1.4. Maximum output jitter is not more than 0,02UIpp (1UIpp=488ns) at frequencies 10 Hz – 100 kHz.

2.2. Receiver options

2.2.1. Receiver input (Rx) is balanced-to-ground and provides following parameters (ITU-T Recommendation G.703):

a) nominal input impedance in the Terminal mode – 120±6 Ohm at frequency 1024 kHz.

b) input impedance in the Monitor mode – not less than 4 kOhm at frequency 1024 kHz;

c) nominal input impedance at the Sync interface – 120±6 Ohm at frequency 1024 kHz.

2.2.2. The receiver of „BERcut-E1" provides an unmistakable reception of signals that are corresponding to following conditions:

a) at frequency 1024kHz, input signal attenuation range is 0 to 36dB in the „long-haul" mode and 0 to 18dB when the „long-haul" mode is off;

b) clock deviation from nominal (2048 kHz) is up to ±6000Hz;

c) peak-to-peak jitter (G.823 measurements) is up to 20Uipp with maximum frequency of 400Hz, and up to 0.4 with minimum frequency of 40kHz (at frequencies range from 400Hz to 40kHz a valid peak-to-peak jitter is scaling down from 20Uipp to 0.4Uipp).

2.2.3. Receiver provides:

a) registration of the current values of code errors or bit errors in range from 0 to $4.29x10^{9}$;

b) indication of the current values of code errors or bit errors. The value can be indicated as integer number or in scientific notation;

c) error rate value $n\ x10^{-m}$ indication in range of $1x10^{-1}$ to $0{,}01x10^{-9}$.

2.2.4. LED indicators:

- LOS – Loss of signal;
- AIS – Alarm indication signal (All 1);
- LOF – Loss of frame ;
- LOM – Loss of multiframe;
- RDI – Remote Defect Indication, transmitted by A-bits in the NFAS-word;
- SER – Errors threshold exceeding indicator. In the BERT mode, the errors threshold is $BER=10^{-3}$, If the CRC synchronization is on than the indication triggers on when more than 30% of CRC-blocks are erroneous;
- RMA – Remote Multiframe Alarm Indication (bit Y in MFAS word is 1 in two consequential multiframes);
- LSS – Loss of sequence synchronization.

2.3. „BERcut-E1" tester allows to use a headset for listening to a channel and talking into a channel.

2.4. USB-interface for a connection to a PC is provided.

2.5. The tester is powered by the AC power adapter for the mains voltage (100 – 240) V at frequencies (50 – 60)Hz, by its internal battery with the nominal voltage 4.8V or by the USB interface.

Power consumption from the mains does not exceed 8VA.

2.6. When tester is powered by mains adapter, duration of the continuous operation is not limited.

When the tester is powered by the internal battery, duration of the continuous operation depends on the operating mode. Minimum duration is not less than 6 hours at the maximum display brightness.

2.7. Mean lifetime – not less than 10 years.

2.8. Mean time before failure – not less than 8000 hours.

2.9. Tester case dimensions: Approx. 85x155x40 mm.

Mains adapter dimensions: Approx. 29x74x80 mm.

2.10. Tester's case weight: approx. 0,4 kg.

Mains adapter weight: approx. 0,07 kg.

3. WHAT'S IN THE BOX

3.1. Components of the „BERcut-E1" tester shipping kit are listed below in the table 3.1.

Table 3.1.

Item	Num.	Note
BERcut–E1 tester	1	
Power supply unit	1	
Data cable №1, №2	2	
Data cable №3	1	with built-in 430Ohm resistors
USB-interface cable	1	
Headset TA06*	1	Optional.
Operating manual	1	
* use of the other type device that does not deteriorate the tester technical parameters is allowed.		

4. “BERcut–E1” OVERVIEW

4.1. „BERcut-E1” tester

4.1.1. The front panel of the “BERcut–E1” analyser is shown on the Figure 4.1.

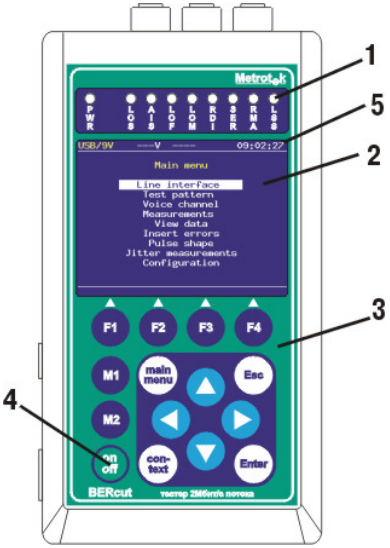

Figure 4.1. Front panel

1. LED indicators
   Three-colours LED indicators provide visual control for the power supply, measurement conditions and data receiving status.
2. Display
   Color LCD display, 320×240 pixels, with the backlight.
3. Keypad
   14-buttons keypad.
4. Power On/Off button.
   To switch on/off the tester push and hold the button for 1-2 seconds.
5. Status bar that contains following parameters (left to right):
   a) Battery voltage level or the “USB/9V” sign when the external power supply through the AC adapter or the USB interface is on;
   b) Symbolic display of the current measurement mode “M”, “P” or “–”: “M” – measurement, “P” – pause, “–” – measurement stopped;
   c) PRBS transmission mode: symbol “S” – sending, “–” – no transmission ;
   d) Error generation status: “E” – errors insertion, “A” – alarms insertion, “–” – normal mode;
   e) Voice frequency (VF) insertion to the specified timeslot mode: symbol “V” – VF insertion from the microphone, “–” – normal mode;
   f) Current time.

4.1.2. LEDs description

PWR – External power supply:

- No light – no external power;
- Green – external power is on ;
- Green/Yellow (blinking) – internal battery is charging.

LOS – Loss of signal:

- Green – no signal loss since reset;
- Red – loss of signal at the moment;
- Yellow – there was loss of signal registered since reset.

AIS – Alarm Indication Signal (All 1):

- Green – no AIS signal has been registered since reset;
- Red – tester is receiving an AIS signal at the moment;
- Yellow – no AIS at the moment, but AIS signal has been registered since reset.

LOF – Loss of frame synchronization:

- Green – frame sync has been detected and there were no loss of synchronization registered since reset;
- Red – no frame sync at the moment;
- Yellow – LOF signal has been registered since reset.

LOM – Loss Of Multiframe synchronization:

- Green – multiframe sync has been detected and there were no loss of synchronization registered since reset;
- Red – no multiframe sync at the moment;
- Yellow – LOM signal has been registered since reset.

RDI – Remote Defect Indication, transmitted by A-bits in the NFAS word:

- Green – no RDI;
- Red – the tester is RDI signal receiving at the moment (A=1 in the NFAS);
- Yellow – no RDI at the moment but there was A=1 in the NFAS registered since reset.

SER – Errors threshold exceeding indication. In a BERT mode, the errors threshold is BER=10^{-3}, If the CRC synchronization is on than the indication triggers on when more than 30% of CRC-blocks are erroneous:

- Green – no threshold exceeding;
- Red – errors threshold is exceeded at the moment;
- Yellow – no threshold exceeding at the moment, but there were at least 1 second with threshold exceeding registered since reset.

RMA – Remote Multiframe Alarm indication (bit Y in MFAS-word is „1” in two sequential multiframes):

- Green – no RMAI signal is registered;
- Red – the tester is receiving alarm indication at the moment;
- Yellow – there is no RMAI signal at the moment, but alarm indication has been registered since reset.

LSS – Loss of sequence synchronization:

- Green – sequence sync has been detected and there were no loss registered since reset;
- Red – synchronization is lost at the moment;
- Yellow – since reset, there was loss of sequence sync registered.

AIS, LOF, LOM, RDI, RMA, SER, LSS indicators are off if the proper event could not or should not be analysed.

4.1.3. Keyboard description

(Enter) – **Enter**

The button provides following functions:

a) in the menu viewing mode (the „menu" keyword is displayed), press the button to access the menu or sub-menu;

b) in the parameters definition mode, press the button to change the value or to move to a submenu. If the (Enter) button is used for parameter value definition then use (Esc) button to return to the previous menu.

(Esc) – **Escape**

Press the button to return to the previous menu or to cancel the data setting in a setup mode.

(main menu) – **Main menu**

Press the button to return to Main menu.

F1 F2 F3 F4 – **Functional buttons (F1, F2, F3, F4)**

M1 M2 – reserved for further use

– **Cursor buttons**

– press the button to move cursor up;

– press the button to move cursor down;

– press the button to move cursor left;

– press the button to move cursor right.

(con-text) – **Context menu (Con-Text)**

Press the button to move to context menu where such functions as LED's reset, display backlight on/off etc. are located.

(on off) – **Power On/Off (On Off)**

To switch on/off „BERcut-E1" press down the button for 1-2 seconds.

4.1.4. External connectors of the „BERcut-E1" are shown on the Figure 4.2

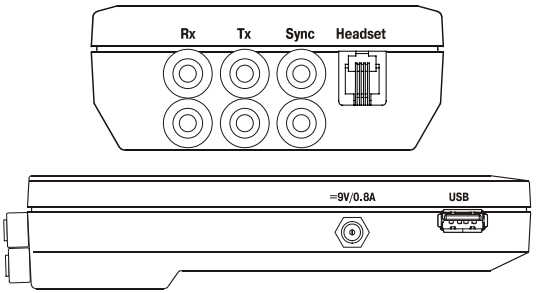

Figure 4.2. „BERcut-E1" external connectors

Connectors functions and devices that could be connected are described in the Table 4.1.

Table 4.1

Connector	Purpose/Function	Connected cable or device
Rx	E1 receive	Measuring cable
Tx	E1 transmit	Measuring cable
Sync	E1 synchronization	Measuring cable
Headset	Connect a headset or a microtelephone	Headset TA06; microtelephone
USB	Connect to PC via USB	USB-interface cable
9V/0.8A	External mains adapter	Mains adapter EPS-3

4.2. „BERcut-E1" components overview

4.2.1. External mains adapter

This adapter provides powering "BERcut–E1" from the mains and charging for internal battery.

The mains adapter is automatic and requires no selection for different line voltages and frequencies.

Input: alternating voltage (100 – 240)V, at frequencies 50 – 60Hz.

Output: direct voltage 9V at current 0,8A, stabilized.

Scheme for the external mains adapter's connector is shown below (Figure 4.3).

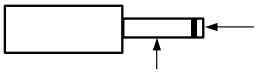

Figure 4.3. External mains adapter connector

4.2.2. The Plantronics TA06 headset (optional) is used to listen to a channel and to talk into a channel. Scheme of the headset connector is shown on Figure 4.4.

Pin number	Description	Wire color
1	Microphone "–"	green
2	Telephone	black
3	Telephone	red
4	Microphone "+"	white

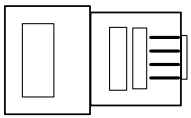

Figure 4.4. Headset connector scheme

4.2.3. Data cables.

Data cables provide direct connection to the tested lines.

Two similar data cables №1 and №2 provide connection to tested lines from the following tester's connectors:

- receiver input Rx in the Terminal mode;
- receiver input Rx in the Monitor mode, using test sockets of the distribution cross with built-in 430Ohm resistors;
- receiver input Rx to monitor the pulse quality of an incoming E1 signal;
- synchronization input Sync;
- transmitter output Tx.

Data cable №3 has the built-in 430 Ohm resistors and provides direct connection to the tested lines in the monitor mode.

4.2.4. USB-interface cable.

Provides connection of the “BERcut–E1” to PC. The circuit of the USB-cable connector is shown on the Figure 4.6.

BERcut–E1	Purpose	PC
1	+5V	1
2	D–	2
3	D+	3
4	GND	4

Figure 4.6. USB-interface cable connector

5. OPERATING THE BERCUT-E1

5.1. Before operating the BERcut-E1 tester; inspect the equipment for any sign of damage, and read this Operating manual thoroughly.

5.2. It is allowed to use BERcut-E1 unit only in an environment that satisfies the operating conditions described in section 1.2 of this manual.

5.3. BERcut-E1 tester should be kept away from extremes of heat, cold, moisture and dust.

5.4. Before operating the BERcut-E1 for the first time or after keeping it in low temperature, leave it for a period of 2 hours at least in the normal (storage) environmental condition.

5.5. When the tester is not in use for a long periods it is recommended to connect off the tester and AC adapter from the mains.

5.6. The BERcut-E1 analyzer can be powered by:

- AC adapter which can operates from the mains voltage 220 V at frequency 50 Hz. When the BERcut-E1 is connected to the mains an internal battery is recharging;
- USR interface.
- Internal battery. Internal battery is a set of 4×AA NimH accumulators (capacity 2100 mAh for each).

5.7. The internal battery.

There is an automatic charging unit built-in the BERcut-E1. This charging unit will be automatically switched on when the external mains adapter is connected.

Regardless of the tester current status (power on or off), an internal battery is charging when the external mains adapter has been connected. When the battery is fully charged the charging unit is automatically cut off.

In the normal (storage) environmental conditions, internal battery's full charge period is not over 8 hours.

User can inspect the battery voltage level with help of an symbolic indicator on the tester's screen (see Figure 4.1). With the disconnected mains adapter and USB interface, the voltage level over 5.2 V points to the fully charged battery. Utterly discharged accumulator's voltage level is 4.0 V or less.

Internal battery lifetime depends on the number of "charge-discharge" cycles. For battery installed by default, 1000 "charge-discharge" cycles allowed.

If the battery is fully charged, an autonomous operating period for the tester is 6 hours at least.

Notes:

1. It is allowed to use NimH or NiCd accumulators of less capacity. In this case the full charge period and operating period will decrease.
2. Use of alkaline or other type batteries (4AA) instead of accumulators is forbidden.
3. When the internal battery is removed, it is allowed to use tester powered by external mains adapter or USB interface.
4. When the battery is utterly discharged or the new battery has been installed, it must be charged for a period of 30 minutes at least, before power up the tester.

6. GENERAL SAFETY SUMMARY

6.1. Review the following safety precautions to avoid injury and prevent damage to the BERcut-E1 analyzer or any products connected to it. To avoid potential hazards, use this instrument only as specified.

Only qualified personnel should perform service procedures.

6.2. Use proper AC adapter. Use only the mains adapter shipped with the BERcut-E1 analyzer.

6.3. Use proper fuse. Use only the fuse type and rating specified for this product.

6.4. Do not operate with suspected failures. If you suspect there is damage to the analyzer, have it inspected by qualified service personnel.

6.5. Do not operate if the analyzer case is damaged.

6.6. Do not operate in wet/damp conditions, in an explosive atmosphere. Keep instrument surfaces clean and dry.

Attention! There is high voltage occurred in the external mains adapter. Operating with the damaged external adapter is forbidden!

7. PRELIMINARY STEPS

7.1. Unpack the „BERcut-E1" tester and inspect it for damage during shipment. Check all components that have been shipped with the unit according to the Table 3.1.

7.2. After unpacking, leave the tester in the normal environmental conditions (refer to section 1.2) for a period of 2 hours at least.

7.3. Connect all components to unit according to Figure 4.2 and Table 4.1.

7.4. Connect the external power supply unit. The „BERcut-E1" tester gets its power from an external mains adapter (power supply unit) which can operate from 100V to 240V at frequencies of 50 to 60 Hz. The power supply unit is automatic and requires no selection for different line voltages and frequencies.

The „BERcut-E1" also has an built-in rechargeable battery. Although this battery was fully charged before packing, it is recommended that you fully charge the tester before using it for the first time.

7.5. Switch the „BERcut-E1" on by pressing the On/Off button (Figure 4.1) for 1-2 seconds.

After switching on, the tester performs a self-test procedure. When the self-testing is complete the Main menu will appear on a display.

The „BERcut-E1" is ready.

Warning:

If there are messages about any errors appear after self-test procedure, the tester is damaged and is a subject to repair.

8. OPERATING „BERCUT-E1”

8.1. Main menu

8.1.1. BERcut-E1 graphical user interface (GUI) is a set of menu screens. Main menu is shown on Figure 8.1. To enter the Main menu press (main menu).

Figure 8.1. Main menu

To select menu point, move the point's line with cursor buttons and press (Enter)

8.1.2. Line interface

This menu section contains analyzer operating parameters. These parameters are obligatory and must be defined before any measurement would be started.

8.1.3. Test pattern

Test pattern menu allows to configure test pattern used for line diagnosis.

8.1.4. Voice functions

This menu point provides an access to voice frequency parameters section.

8.1.5. Measurements

The **Measurements** menu point allows to start/stop measurements of basic parameters and measurements according to G.821 and G.826/M.2100 ITU-T recommendations with possibility to view and save measured results.

8.1.6. View data

This menu point provides an access to monitor frame contents, and contents of CAS/MFAS or FAS/NFAS words.

8.1.7. Insert errors

The **Insert errors** section allows to insert errors of various types and to generate different types of alarms.

8.1.8. Configuration

The **Configuration** menu point provides an access to configure analyzer's basic settings and line interface parameters.

8.2. Line interface menu

8.2.1. To access **Line interface** section, in the Main menu highlight the menu point and press (Enter). Line interface menu screen is shown on Figure 8.2.

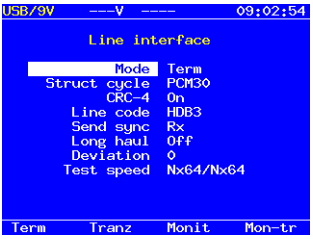

Figure 8.2. "Line interface" menu

8.2.2. Mode

Mode field: select BERcut-E1 operating mode from the following list:

– **Term** (F1) – „Terminal" mode;

– **Tranz** (F2) – „Transit" mode;

– **Monit** (F3) – „Monitor" mode;

– **Mon-tr** (F4) – „Transit-Monitor" mode.

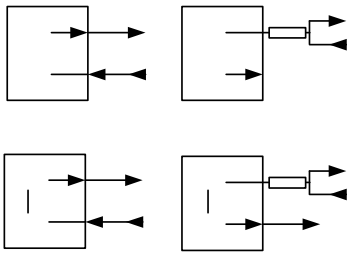

Figure 8.3. Tester's operation modes

Terminal mode

This mode is used for out-of-operation channels.

In this mode, BERcut-E1 is connected to tested line as terminal and is used to receive and transmit E1 signal. Terminating load of the analyzer is 120 Ohms.

Transit mode

In the Transit mode, received signal is transmitted by the tester. This mode can be used for both in-service and out-of-service measurements.

Incoming signal (Rx) is received at terminating load of 120Ohms. Then the signal is re-generated and retransmitted through the TX connector. This mode is alike Terminal mode, but in Transit mode BERcut-E1 uses received data stream to generate transmitted data. Informational channels are retransmitted without changes unless the Insert errors mode is active. Signalling and synchronization signals are generated by the BERcut-E1 analyser.

Monitor mode

Monitor mode is intended for in-service monitoring access.

In this mode, the analyzer is connected to the tested system through the high impedance resistors (connection to the „MONITOR" socket of the tested equipment).

Transit-monitor mode

This mode is intended to send the signal trough the analyzer. Received signal is to regenerate and transmit through Tx connector. Incoming signal should be received only from „MONITOR" socket of the tested equipment. Transit-monitor mode allows to include or exclude a channel from an operating system.

Warning!

When connecting directly to tested line cables, data cable #3 with 430 Ohms resistors must be used*.

* Note:

Though the input impedance of the tester in Monitor mode at Rx connector exceeds 4kOhm; the use of data cables №1 or №2 to monitor the pulse shape can cause the line function violation by one of the following reasons:

– accidental switching to the Terminal mode cause the extra impedance of 120Ohms connection (signal loosening at 3.5 dB or unbalance for a long haul).
– powering off the tester (accidental or automatically due to battery discharge) causes the symmetrical maximum amplitude limit at level of ±0.6V by protective diodes at the tester's input.

8.2.3. Structure cycle

Select the frame structure from the following list:

– **PCM-30** (F1);
– **PCM-31** (F2);
– **Unstr** (F3) – unstructured data stream.

PCM-31 mode is used when the tested system operates without multiframe synchronization (e.g. systems with common channel signalling).

PCM-30 mode is used to test systems which operate with multiframe synchronization (e.g. systems with channel associated signalling).

The specific frame structure must be selected when:

– you know what kind of structure is used on tested system;
– E1-signal is not available at the moment of tester's connection to an equipment to be tested;
– the BERcut-E1 tester is used cooperatively with another testing tool which is already operating in the auto-identification mode;
– the tester is to control the frame structure of the E1-signal.

Unstr. mode should be selected to test the systems that do not use either frame nor multiframe synchronization.

8.2.4. CRC-4

Select one of the states: **On** (F1), **Off** (F2), **Inv.** (F3). to allow to measure CRC-4 errors for incoming signal; or to transmit CRC-4 bits into the outgoing signal. If you are in doubt about the CRC-4 configuration then select **Off**.

8.2.5. Line coding

Select **AMI** (F2) or **HDB3** (F1) type of line coding.

8.2.6. Transmitter synchronization:

– from input data stream at Rx connectors (F1)
– from internal clock (F2)
– from E1 stream at Sync connector (F3)

8.2.7. Long haul

To compensate the signal attenuation and to equalize the amplitude frequency response, there is an internal equalizer in the BERcut-E1 tester. The equalizer should be used only in the „Long haul" mode.

Long haul mode is on – the equalizer is on, signal level is up to – 36dB;

Long haul mode is off – the equalizer is off, minimum signal level is – 18dB.

To switch Long haul mode on/off use the (F1) and (F2) buttons.

8.2.8. Test speed

Select the test speed from the following values: **N×64** or **2048K**. If you are not sure about selection, set the 2.048 Mbit/s value. To set the N×64 kbit/s test speed press F2 button (N×64); and then the **Select timeslots** section will appear on the screen (Figure 8.4).

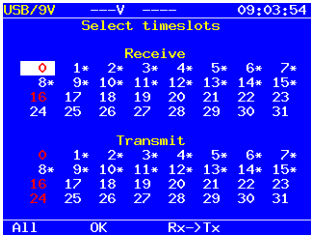

Figure 8.4. "Select timeslots" mode

In the **Select timeslots** menu select every receive or transmit timeslot in N64 sequence: select needed timeslot with cursor buttons and press Enter to invert the timeslots status.

When timeslots are properly configured, press the Enter button (OK). The tester will be reconfigured according to those new settings for N×64.

Press Main menu button to return to the main menu.

8.3. Test pattern menu

8.3.1. In the main menu, select the **Test pattern point** and press Enter button. „Test pattern" section will appear on the screen (Figure 8.5).

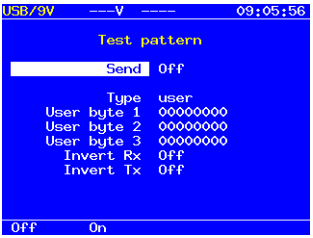

Figure 8.5. "Test pattern" menu

8.3.2. Send

Send field allows to start / stop the transmission of the currently defined pattern in the timeslots which were selected in the **Line interface** – **Test speed** menu.

8.3.3. Type

Type field: select the test pattern type to generate:

- **All 1** – all 1;
- **All 0** – all 0;
- **55** – 55;
- **2e6** – generate 2^6–1 PRBS;
- **2e9** – generate 2^9–1 PRBS;
- **2e11** – generate 2^{11}–1 PRBS;
- **2e15** – generate 2^{15}–1 PRBS;
- **2e23** – generate 2^{23}–1 PRBS;
- **user** – generate the user defined pattern.

8.3.4. User byte 1, User byte 2, User byte 3

These fields allow to define least significant byte of the alternative/user defined pattern.

8.3.5. Invert. RX:

Invert RX field: switch on/off the receive pattern inversion.

8.3.6. Invert TX:

Invert TX field: switch on/off the transmit receive pattern inversion.

8.4. Voice functions menu

8.4.1. To switch to the Voice functions menu move the cursor to the proper line in the main menu and press (Enter) button. Voice function section will appear on the screen (Figure 8.6).

Figure 8.6. "Voice functions"

8.4.2. T/S send

T/S send field: select the timeslot number into which the voice data will be sent.

To change timeslot number press the Enter button. The „Select timeslots" subsection will appear on the screen. Highlight needed timeslot with cursor buttons and press Enter button. „Select timeslots" screen is shown on Figure 8.7.

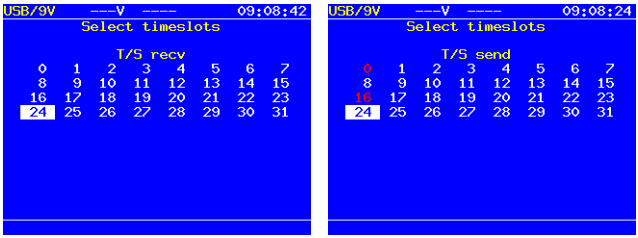

Figure 8.7. "Select timeslots"

8.4.3. Source

This field is used to select the voice data transmission mode:

– **Off (F1)** – voice transmission into the channel is switched off;

– **Mic (F2)** – send voice into the channel.

8.4.4. CAS

CAS field points the CAS tetrad which will be inserted into the CAS-bits field corresponding to selected channel.

8.4.5. Sensitivity

Sensit. field is used to adjust the microphone sensitivity.

8.4.6. T/S receive

T/S recv field: select timeslot to receive voice frequency from. To change timeslot number, press Enter button and „Select timeslot" menu will appear on the screen. Algorithm of receive timeslots select is the same to select transmit timeslots described in subsection 8.4.2.

8.4.7. CAS

CAS field shows signaling tetrad which is corresponding to selected channel's CAS-bits field.

8.4.8. Phone

Phone field: switch on/off the headset phone.

8.4.9. Volume

Volume field: adjust the headset telephone volume level.

8.4.10. Coding law

Coding field allows to set audio coding law (A-law or μ-law).

8.5. Context menu

Context menu (Figure 8.8) allows to adjust the backlight brightness of the display; to switch on/off keypad buttons' beep; and to reset the LEDs. To enter the Context menu press (context) button.

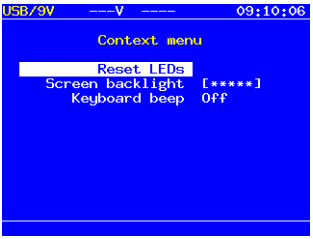

Figure 8.8. Context menu

8.6. Measurements menu

8.6.1. **Measurements** menu contains the most important and frequently used results of measure. This section consists of the following five screens (subsections):

- **Basic parameters**;
- **Basic parameters 2**;
- **G.821**;
- **G.826/M.2100 (near end)**.
- **G.826/M.2100 (far end)**.

To switch between screens (subsections) use cursor buttons.

For save and load parameters use F3 and F4 buttons.

Basic parameters (divided in 2 screens) sections contain counters and rates for detected events.

G.821 section displays results for measurements according to ITU-T G.821 recommendation.

G.826/M.2100 section shows results for G.826/M.2100 measurements. This subsection is also divided in two screens – for near and far end accordingly.

Most of results have an accumulative counter (first column) and the proper rate or ratio (second column). For example, CODE (code errors counter) is shown in the first column; and CODER (code errors rate) is displayed in the second column of the same row.

8.6.2. Basic parameters

Basic parameters screen is shown on Figure 8.9.

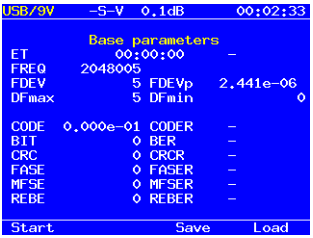

Figure 8.9. "Basic parameters"

Following parameters are displayed in this section:
- RT – remaining time – time remains till the end of measurements session;
- ET – elapsed time – time elapsed since the measure start moment;
- CODE – code errors counter; and CODER – code error rate;
- BIT – bit errors counter; and BER – Bit Error Rate;
- CRC – CRC-4 errored blocks counter; and CRCR – CRC-4 errored blocks rate;
- FASE – Frame Alignment Signal Errors counter; and FASER – Frame Alignment Signal Errors Rate;
- MFSE – MultiFrame Signal Errors counter; MFSER – MultiFrame Signal Errors rate;
- REBE – Remote E-Bit errors counter; and REBER – Remote E-Bit Errors Rate.

8.6.3. Basic parameters 2

Basic parameters 2 subsection screen is shown on Figure 8.10.

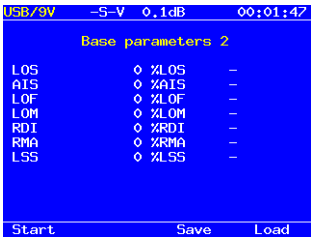

Figure 8.10. "Basic parameters 2"

Following parameters are displayed on this screen:
- LOS -- Loss Of Signal counter (seconds) and its ratio – %LOS
- AIS -- Alarm Indication Signal counter (seconds) and its ratio – %AIS
- LOF – Loss of frame alignment counter (seconds) and its ratio – %LOF
- LOM – Loss of Multiframe alignment counter (seconds) and its ratio – %RDI
- RDI – Remote defect indication counter (seconds) and its ratio – %RDI
- RMA – Remote Multiframe alarm counter (seconds)and its ratio – %RMA
- LSS -- Loss of Sequence Synchronization counter (seconds) and its ratio – %LSS

8.6.4. G.821

G.821 screen is shown on Figure 8.11.

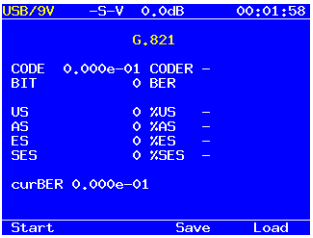

Figure 8.11. "G.821"

Following parameters are displayed in this screen:

– CODE – code errors counter; and CODER – code error rate;
– BIT – bit errors counter; and BER – Bit Error Rate;
– US – Unavailable Seconds counter and Unavailable Seconds ratio – %US;
– ES – Errored Seconds counter and Errored Seconds ratio – %US;
– SES – Severely Errored Seconds counter and Severely Errored Seconds ratio – %SES
– AS – Available Seconds counter and Available Seconds ratio – %AS;
– curBER – current Bit Error Rate time-averaged for a 10 seconds period.

8.6.5. G.826/M.2100

G.826/M.2100 screen is shown on Figure 8.12.

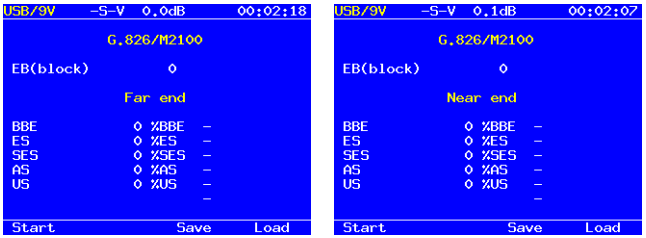

Figure 8.12. "G.826/M.2100"

For both near and far ends the following parameters are displayed:

– EB – Errored Blocks counter;
– BBE – Background Block Errors counter, and its ratio – %BBE;
– US – Unavailable Seconds counter, and Unavailable Seconds ratio – %US;
– ES – Errored Seconds counter, and Errored Seconds ratio – %US;
– SES – Severely Errored Seconds counter, and Severely Errored Seconds ratio – %SES
– AS – Available Seconds counter, and Available Seconds ratio – %AS.

8.7. View data

8.7.1. **View Data** menu allows to view contents of a frame, CAS/MFAS words and FAS/NFAS words. The menu screen is shown on Figure 8.13.

Figure 8.13. "View data" menu

8.7.2. View FAS/NFAS

FAS/NFAS menu provides review of FAS/NFAS words content for last 16 frames. To stop content refreshing, press F1 button (Pause). To view S-bits of NFAS word press F2 button.

FAS/NFAS screen is shown on Figure 8.14.

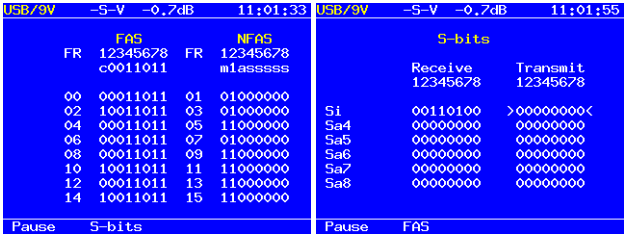

Figure 8.14. "FAS/NFAS" screen

8.7.3. View CAS/MFAS

CAS/MFAS menu provides review of CAS/MFAS words content for last 16 frames. To stop content refreshing, press F1 button (Pause).

CAS/MFAS screen is shown on Figure 8.15.

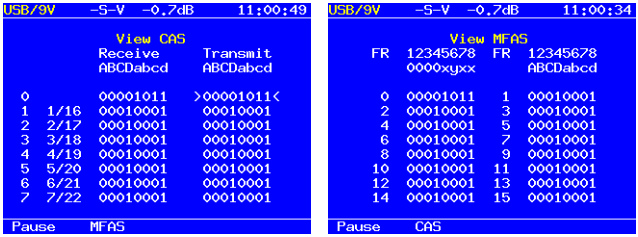

Figure 8.15. "CAS/MFAS" screen

8.7.4. Frame monitoring

Frame monitoring menu allows to view frame content. To scroll screens of frame content use cursor buttons: ▲ – one page up, ▼ – one page down. To stop the view mode press F1 button (Pause) – frame content data will not be refreshing. The Frame monitor screen is shown below on Figure 8.16.

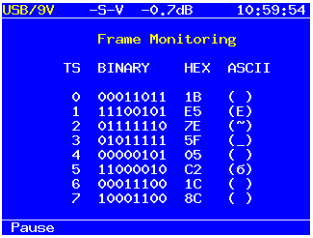

Figure 8.16. “Frame monitor” screen

8.8. Insert errors menu

8.8.1. The **Insert errors** menu allows to insert errors of different types; and to generate alarms of different types. The menu screen is shown on Figure 8.17.

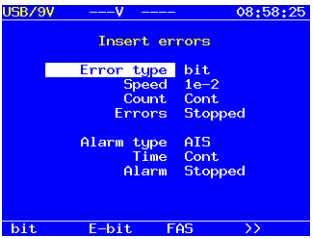

Figure 8.17. “Insert errors” menu

8.8.2. Error type

Error type field allows to select the error type from the following list:

– **bit** – bit errors insertion;
– **E-bit** – generate bit errors in PRBS;
– **FAS** – generate errors in FAS word;
– **MFAS** – generate errors in MFAS word;
– **CRC** – CRC errors insertion;
– **REBE** – REBE errors insertion.

8.8.3. Speed

The **Speed** field: select the errors insertion speed from the followings: **10^{-1}**; **10^{-2}**; **10^{-3}**; **10^{-4}**; **10^{-5}**; **10^{-6}**; **10^{-7}**.

8.8.4. Count

The **Count** field: select count of errors to be inserted: Cont – continuous errors insertion; 1; 10; 100; 500; 1000; 5000.

8.8.5. Errors

The **Errors** field allows to control (to start or to stop) the error insertion process.

8.8.6. Alarm type

Alarm type field: select alarm type to be generated from the following list:

– **LOS** – loss of signal. Transmitter is cut off;

- **AIS** – alarm indication signal. Transmitter sends all ones;
- **LOF** – loss of frame. Loss of FAS synchronizing signal;
- **LOM** – loss of multiframe. Loss of MFAS synchronizing signal (all ones in timeslot 16);
- **RDI** – remote defect alarm (ITU-T Recommendation G.706). In this case, the tester transmits „1" in every third bit of each frame in null timeslot which does not contain the frame synchronization signal. The FAS DISTANT alarm signal can be transmitted only with PCM-30 and PCM-30;
- **RMA** – remote multiframe alarm (ITU-T Recommendation G.732). For this alarm signal, the analyser sends „1" in every sixth bit of each sixteenth timeslot in the null frame. The FAS DISTANT alarm signal can be transmitted only with PCM-30;
- **ARTF** – unstructured data stream of interlaced ones and zeros transition;
- **LSS** – loss of synchronization with receive test pattern.

8.8.7. Time

Time field: select the duration of alarm generating process:

- **0.1** – 0.1sec;
- **0.5** – 0.5 sec;
- **1** – 1 sec;
- **2** – 2 sec;
- **5** – 5 sec;
- **Cont** – continuous alarm generation.

8.8.8. Alarm

Alarm field allows to control (to start and to stop) the alarm generating process.

8.9. Configuration menu

8.9.1. **Configuration** menu allows to configure base setting parameters, line interface parameters and summary information about BERcut-E1 software versions.

Configuration menu screen is shown on Figure 8.18.

To get summary info about software version press M1 button.

Figure 8.18. Menu "Configuration"

8.9.2. Basic settings

When you would select the **Basic setting** menu point the following settings' subsection appears on the screen (Figure 8.19.):

Figure 8.19. Menu "Basic settings"

Following parameters could be defined in this subsection:

– **Time**: current time;
– **Date**: current date;
– **Meas. time**: time of measurement. This parameter allows to define the period for automatic measure stop. To disable this function set the measurement time value to 00:00;
– **Auto power off**: Automatic power off modes which are depending on several criterions:
  • **Off** – function is disabled;
  • **Type 1** – the tester is powered off if there were no keypress for 10 minutes and there is no active measurement neither test pattern or alarm generation;
  • **Type 2** – the tester is powered off if there were no keypress for 10 minutes and there is no active measurement at the moment;
  • **Type 3** – the tester is powered off if there were no keypress for 10 minutes.
– **LCD auto off**: display auto-off function;
– **Language**: change the GUI's language.

8.9.3. Line interface

Line interface subsection screen is shown on Figure 8.20.

Figure 8.20. "Line interface" sub-menu

S bits field: intended to keep S-bits which are inserted into NFAS words.

CAS field: intended to keep CAS tetrad which is to be inserted into channel-corresponding CAS-bit fields.

Ch value field: is intended to keep the silence code content which is inserted into all transmission-free channels.

Gener. ARA field: switch on/off the automatic alarm generation (A-bits in NFAS) for far end in case of synchronization loss (loss of signal).

Gener. AAIS field: switch on/off the automatic AIS signal generation for far end in case of synchronization loss (loss of signal).

Gener. AEBE field: automatic E-bit generation on/off.

All those fields are automatically loaded when the tester is switched on.

8.10. Pulse shape **(option)**

8.10.1. **Pulse shape** menu allows the user to monitor the pulse quality of an incoming E1 signal. Selecting the Pulse shape menu switches the instrument to pulse shape analysis mode, the unit will begin capturing data and display the pulse shape within a G.703 Mask.

The displayed mask is the simplified version of the G.703 Mask which is shown on Figure 8.21.

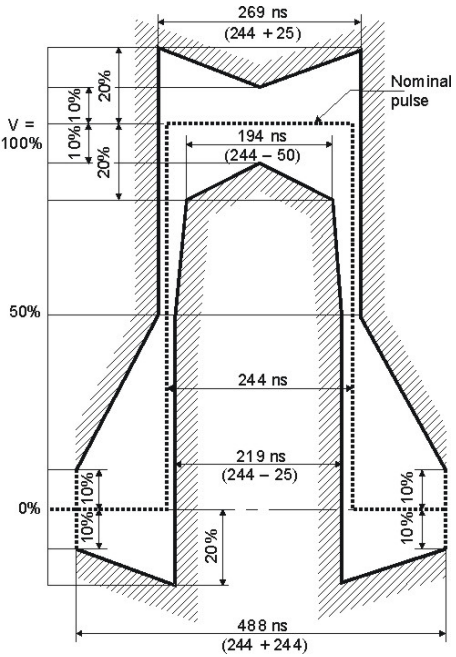

Figure 8.21. Pulse Mask G.703 (2048 kbit/s)

8.10.2. Operating in the Pulse shape mode:

8.10.2.1. Switch on the tester on off.

8.10.2.2. Connect the data cable №1.

Warning:

Though the input impedance of the tester in Monitor mode at Rx connector exceeds 4kOhm; the use of data cables №1 or №2 to monitor the pulse shape can cause the line function violation by one of the following reasons:

– accidental switching to the Terminal mode cause the extra impedance of 120Ohms connection (signal loosening at 3.5 dB or unbalance for a long haul).
– powering off the tester (accidental or automatically due to battery discharge) causes the symmetrical maximum amplitude limit at level of ±0.6V by protective diodes at the tester's input.

8.10.2.3. In the "**Line interface**" menu, select Terminal (if the tester is connected as a terminal with terminating load of 120 Ohms) or Monitor (if the tester is connected to the line trough high impedance resistors) operating mode.

8.10.2.4. Connect the data cable to the line to be tested.

Warning:

Disconnect the data cable from the tested line before switching off the instrument.

8.10.3. Pulse shape.

The Pulse shape screen is shown on the figure below.

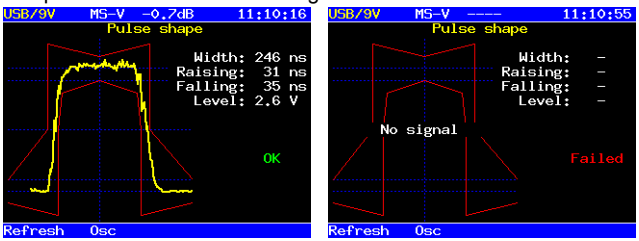

Figure 8.22. Pulse shape

To update displayed data press F1 button.

The program automatically places the pulse into the Pulse Mask (ITU-T G.703) by shifting pulse in time and scaling its amplitude.

Due to measurement algorithm specifics, the displayed pulse shape can differ from the real pulse shape depending on one of the following reasons:

– signal amplitude exeeds the value of ±5V (overflow);
– there is jitter in line signal;
– regular line signal (e.g. in most timeslots zeros are transmitting).

To clear up the reason of signal distortion, it is possible to view an oscilloscope of the signal and to view the frame contents in the "View data/Frame monitoring" section. If the reason is the regular line signal change the timeslots filling or send AIS signal into the channel. To view oscilloscope press F2.

8.10.4. Oscilloscope.

The one-shot sample of the signal at the interval of 4 mcs is displayed. In this mode, the passband is from 0.01 to 10MHz. If signal amplitude exeeds ±5V, peaks could be observed on the oscilloscope (overflow). An example of oscilloscope screen is shown on Figure 8.22 (vertical grid – 250ns, horizontal grid value is displayed in up-left corner of the screen).

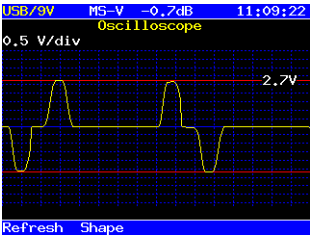

Figure 8.22. Oscilloscope screen

To update displayed data press F1 button.

To switch to the pulse shape monitor mode press the F2 button.

To increase the signal level by 6 or 12 dB press the F4 button.

8.11. Jitter measurements menu **(option)**

8.11.1. **Jitter measurements** menu allows to measure and analyse jitter in the receive signal. An example of measurement results is shown on the Figure 8.23. (horisontal grid spacing – 1sec., vertical grid spacing – 0.5 UI)

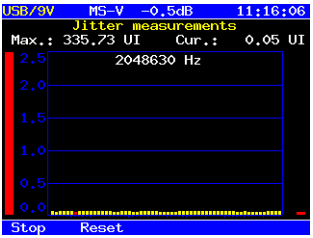

Figure 8.23. Menu "Jitter measurements"

To start measure press the F1 button.

To clear the screen press the F2 button.

9. TROUBLESHOOTING

Possible malfunctions and methods of their repair are described in Table 9.1.

Table 9.1

Malfunction symptoms	Possible reason	How to repair
Power does not turn on	The built-in battery is low	Charge the battery with the external power supply unit.
Power turns on but no LEDs test is performed	Tester is damaged	Call to the Technical Support Center
Tester power is on but display remains dark (no information on the screen)	Display brightness is set to minimum value.	Adjust display brightness with the context menu
System time is not correct	Reset has been performed (Reset button has been pressed)	Set proper system time through the menu “Configuration” –> “Basic settings”
When connected to USB-interface, no new COM-port is detected	Virtual COM Port driver is not installed on your PC	Download and install proper driver from http://ftdichip.com/FTDriver.htm
The built-in battery is not charging from the external power supply.	Mains adapter or its connector is damaged, internal battery is damaged.	Check the mains adapter and replace it if needed; replace the internal battery
Operation time with fully charged battery is less than 4 hours	Battery life cycle is over	Change the battery
All data cables are properly connected but LOS is registered	„Long-haul” mode is not active	Activate “Long-haul” mode
Test pattern is set, but LSS status is registered	Numbers of timeslots on transmission and reception are not corresponding to each other.	Set proper timeslots numbers
In the „loop back” test mode errors appear.	Synchronization from the input stream is active.	Select synchronization mode from internal or external clock.

10. SERVICING THE BERCUT-E1

10.1. The maintance for the „BERcut-E1" tester comes to periodical check of tester's body, power supply unit / AC adapter and cables to keep them clean and in operating condition.

10.2. Repairs to the BERcut-E1 should only be conducted by a service personnel from Metrotek. Any problem with the BERcut-E1 can be referred to our customer service department.

11. SHIPPING THE BERCUT-E1

11.1. When the BERcut-E1 is being shipped via commercial carrier, it should be packed in its original packing or an equivalent packaging Ensure the tester is sealed off and protected from static damage.

11.2. When the BERcut-E1 is to be shipped ensure it is switched off and all cables have been disconnected. Do not place any cables or accessories directly against the unit, as this may scratch the instrument during transportation.

APPENDIX A

(reference)
GLOSSARY

Table A.1

Term	Definition
AMI	Alternative Mark Inversion
AIS	Alarm Indication Signal
BER	Bit Error Rate
BERT	Bit Error Rate Testing
CAS	Channel Associated Signalling
CRC	Cyclic Redundancy Check
FAS	Frame Alignment Signal
HDB3	High Density Bi-Polar
ITU	International Telecommunications Union
ITU-T	ITU, Telecommunication Standardization Sector
LOF	Loss Of Frame
LOS	Loss Of Signal
LOMF	Loss Of Multiframe
LOSS	Loss Of Signal Seconds
MFAS	Multi Frame Alignment Signal
NFAS	Not Frame Alignment Signal
PCM	Pulse Code Modulation
PCM 30	PCM-30 system with 30 channels and the CAS in the TS 16
PCM 31	PCM-31 system without CAS
RDI	Remote Defect Indication
RMAI	Remote Multiframe Alarm Indication

APPENDIX B

(reference)

SIGNALLING TABLES

B.1. Structure of the PCM-30 frame

Table B.1

TS0	TS1	TS2	TS3	....	TS15	TS16	TS17	TS18	TS19	....	TS30	TS31
FAS	Ch1	Ch2	Ch3	....	Ch15	Signaling	Ch16	Ch17	Ch18	....	Ch29	Ch30

B.2 Structure of the PCM multiframe

Table B.2

Frame	TS0	TS1	TS2	...	TS15	TS16	TS17	TS18	TS19	...	TS30	TS31
0	FAS	Ch1	Ch2	...	Ch15	MFAS	Ch16	Ch17	Ch18	...	Ch29	Ch30
1	NFAS	Ch1	Ch2	...	Ch15	Ch1-Ch16	Ch16	Ch17	Ch18	...	Ch29	Ch30
2	FAS	Ch1	Ch2	...	Ch15	Ch2-Ch17	Ch16	Ch17	Ch18	...	Ch29	Ch30
3	NFAS	Ch1	Ch2	...	Ch15	Ch3-Ch18	Ch16	Ch17	Ch18	...	Ch29	Ch30
4	FAS	Ch1	Ch2	...	Ch15	Ch4-Ch19	Ch16	Ch17	Ch18	...	Ch29	Ch30
5	NFAS	Ch1	Ch2	...	Ch15	Ch5-Ch20	Ch16	Ch17	Ch18	...	Ch29	Ch30
6	FAS	Ch1	Ch2	...	Ch15	Ch6-Ch21	Ch16	Ch17	Ch18	...	Ch29	Ch30
7	NFAS	Ch1	Ch2	...	Ch15	Ch7-Ch22	Ch16	Ch17	Ch18	...	Ch29	Ch30
8	FAS	Ch1	Ch2	...	Ch15	Ch8-Ch23	Ch16	Ch17	Ch18	...	Ch29	Ch30
9	NFAS	Ch1	Ch2	...	Ch15	Ch9-Ch24	Ch16	Ch17	Ch18	...	Ch29	Ch30
10	FAS	Ch1	Ch2	...	Ch15	Ch10-Ch25	Ch16	Ch17	Ch18	...	Ch29	Ch30
11	NFAS	Ch1	Ch2	...	Ch15	Ch11-Ch26	Ch16	Ch17	Ch18	...	Ch29	Ch30
12	FAS	Ch1	Ch2	...	Ch15	Ch12-Ch27	Ch16	Ch17	Ch18	...	Ch29	Ch30
13	NFAS	Ch1	Ch2	...	Ch15	Ch13-Ch28	Ch16	Ch17	Ch18	...	Ch29	Ch30
14	FAS	Ch1	Ch2	...	Ch15	Ch14-Ch29	Ch16	Ch17	Ch18	...	Ch29	Ch30
15	NFAS	Ch1	Ch2	...	Ch15	Ch1-Ch30	Ch16	Ch17	Ch18	...	Ch29	Ch30

B.3 Structure of the PCM-30 multiframe synchronization word

Table B.3

Frame	Word	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8
0	FAS	S_{i1}-CRC_1	0	0	1	1	0	1	1
1	NFAS	S_{i2}-0*	1	A	S_n	S_n	S_n	S_n	S_n
2	FAS	S_{i1}-CRC_2	0	0	1	1	0	1	1
3	NFAS	S_{i2}-0*	1	A	S_n	S_n	S_n	S_n	S_n
4	FAS	S_{i1}-CRC_3	0	0	1	1	0	1	1
5	NFAS	Si2-1*	1	A	S_n	S_n	S_n	S_n	S_n
6	FAS	S_{i1}-CRC_4	0	0	1	1	0	1	1
7	NFAS	S_{i2}-0*	1	A	S_n	S_n	S_n	S_n	S_n
8	FAS	S_{i1}-CRC_1	0	0	1	1	0	1	1
9	NFAS	S_{i2}-1*	1	A	S_n	S_n	S_n	S_n	S_n
10	FAS	S_{i1}-CRC_2	0	0	1	1	0	1	1
11	NFAS	S_{i2}-1*	1	A	S_n	S_n	S_n	S_n	S_n
12	FAS	S_{i1}-CRC_3	0	0	1	1	0	1	1
13	NFAS	S_{i2}	1	A	S_n	S_n	S_n	S_n	S_n
14	FAS	S_{i1}-CRC_4	0	0	1	1	0	1	1
15	NFAS	S_{i2}	1	A	S_n	S_n	S_n	S_n	S_n

CRC_1 – CRC_4 – CRC bits.
S_n – Bits reserved for national use.
S_{i1}&S_{i2} – Bits reserved for international use.
***** – Multiframe CRC synchronization.
A – Far end alarm indication.

B.4. Channel Associated Signalling

Table B.4

Frame	TS 16, bits 0-3	TS 16, bits 4-7
0	MFAS (0000)	xyxx
1	Ch01 abcd	Ch16 abcd
2	Ch02 abcd	Ch17 abcd
3	Ch03 abcd	Ch18 abcd
4	Ch04 abcd	Ch19 abcd
5	Ch05 abcd	Ch20 abcd
6	Ch06 abcd	Ch21 abcd
7	Ch07 abcd	Ch22 abcd
8	Ch08 abcd	Ch23 abcd
9	Ch09 abcd	Ch24 abcd
10	Ch10 abcd	Ch25 abcd
11	Ch11 abcd	Ch26 abcd
12	Ch12 abcd	Ch27 abcd
13	Ch13 abcd	Ch28 abcd
14	Ch14 abcd	Ch29 abcd
15	Ch15 abcd	Ch30 abcd
x = spare bits y = loss of multiframe Note – abcd should never be set to “0000” for this will cause the malfunction of the multiframe synchronization.		

B.5 CAS signalling codes

Table B.5

Sync conditions		4-bit signaling code
Forward Direction (outgoing to incoming)	**Backward Direction (incoming to outgoing)**	
		0000
Trunk Offering	Manual Hold	0001
		0010
Circuit Seized	Called-Subscriber Answer (CSA)	0011
		0100
Earth (Sig System AC8)	Earth (Sig System AC8)	0101
		0110
	Circuit Free	0111
		1000
	Coin Fee Check (CFC)	1001
		1010
Dial Break		1011
		1100
Disconnection (SSAC8)	Disconnection (SSAC8)	1101
		1110
Circuit Idle	Circuit Busy	1111

Note – Dialing digits are transmitted with nominal rate of 10pps (pps – pulse per second). Pulse is a sequence (1011) that is applied for 66.66ms, and is followed by sequence (0011) which is usually applied for 33.33ms. Pulse period (sequence 0011) lasts usually 250ms minimum.