LLC «Sigrand»

SHDSL MODEM
“SIGRAND SG-17B”

User’s guide
v. 1.0

Novosibirsk
2009

Standard 6665-017-77565155-2007

Contents

About “User’s guide”

For the sake of convenience in the “User’s guide” the following symbols and relevant fonts are used:

Symbols

Symbol	Meaning	Explanation
➔	Attention!	This symbol marks the sections containing information useful for the device setup and operation.
	Important!	Paragraph, marked with this symbol, contains important clarifications on the program’s peculiarities, which may save you time and effort while setting up the device.
	Danger!	This information will help you avoid equipment damage or life hazard.

Fonts

Indication	Explanation
`Picture on the screen`	In such way the content of the terminal screen while setup is shown.
Key on the keyboard	Keys on the keyboard, used for the modem setup via console are typed **in this font**. Example: **Enter**
Choose *Properties* in the *File* menu	Menu program buttons in the text and parts of the User's guide containing important information (combined with a symbol) are *italicized*.
`stat`	Commands operating modem with the help of a terminal program are **`bold`.**

Before you set up the modem, we recommend that you make sure the latest edition of the User's guide and the latest updates of the firmware and drivers are available on our site www.sigrand.com

1. **Modem description**

The Sigrand SG-17B modem is a SHDSL modem featuring an Ethernet-bridge. The modem is designed to connect distributed local networks, remote computers and other devices equipped with Ethernet interface. The bridge can transmit VLAN IEEE 802.1Q tagged packets both via DSL and Ethernet interfaces.
The interface used in the SHDSL modem conforms to the ITU-T G.991.2.bis standard and uses the TCPAM (Trellis-Coded Pulse Amplitude Modulation) line coding for transmission.

Compatibility:
The Sigrand SG-17B modem's line interface is compatible with all SHDSL Sigrand modules of the MR-17H, MR-17HP series of the Sigrand SG-17R router.

➔ *The possible data rate range is limited if modules with maximum data rate of 5.7 MBps are used.*

The modem features the following interfaces:

- One ITU-T G.991.2.bis standard SHDSL interface providing a 192 to15296 kbps data rate.
- One Ethernet 10/100Mb (IEEE 802.3) interface with automatic rate adjustment and auto MDI/MDI-X.
- One USB 2.0 interface for modem management.

1.1 DSL interface specifications

Link type	pint-to-point
Number of wires per line	2 (one pair)
Cable type	any UTP
Line coding	TCPAM
Input/output impedance, Ω	135
Data rate range, kbps	192-15296
Data rate step, kbps	64

Transmission type	full duplex
Data transfer mode	synchronous, by packets
Packet type	HDLC
Checksum	CRC32
Connector type	RJ-45
Galvanic isolation transformer breakdown voltage, min, V	1500
Surge protector triggering voltage (differential), V	30
Discharge arrester breakdown voltage (common-mode), V	350

1.1.1 The Sigrand SG-17B maximum reach performance

Table 2 gives brief information about the Sigrand SG-17 modem maximum reach performance. The Bit Error Rate (BER) is equal to or less than 10^{-7}. The specified reach was experimentally proved on the Sigrand lab reference line. Full version of the table is available at www.sigrand.com. Actual reach may differ from the given values due to the inequality of the features of real lines and those of the model cable.

Table 2

Data rate (kbps)	Line coding	Rating	TPP 100-0.5 cable (24 AWG)
15296	TCPAM128	Length (km/ft)	**0.6/1969**
		R (Ω)	150
10240	TCPAM64	Length (km/ft)	**1.8/5906**
		R (Ω)	324
7168	TCPAM64	Length (km/ft)	**2.8/9187**
		R (Ω)	504
5696	TCPAM32	Length (km/ft)	**3.4/11155**
		R (Ω)	612
3072	TCPAM16	Length (km/ft)	**5/16405**
		R (Ω)	900

2304	TCPAM16	Length (km/ft)	**5.4/17700**
		R (Ω)	972
1024	TCPAM16	Length (km/ft)	**7.8/25592**
		R (Ω)	1404
512	TCPAM16	Length (km/ft)	**9.0/29500**
		R (Ω)	1620
256	TCPAM16	Length (km/ft)	**10.0/32800**
		R (Ω)	1800

1.2 Ethernet interface specifications

Interface type	10/100 Base-T
Number of ports	1
Data transfer rate, Mbps	10/100
Mode type	half and full duplex
Compatibility	ANSI/IEEE Std 802.3
Auto MDI/MDI-X	available

1.3 USB interface specifications

Protocol	USB 2.0
Connector type	miniUSB

1.4 Power supply unit

Power supply from a local power source (Sigrand SG-17B)

Input voltage	3.3V
Polarity of the plug's central contact	positive

Power supply via xDSL from a remote power source (Sigrand SG-17BP)

Input voltage	100÷250B

Attention!
The way of power supply is selected with order. The options are local source power supply and power supply remote source via xDSL.

1.5 Other specifications

Modem overall dimension	
• height, mm/in	25.5/1
• width, mm/in	82/3.23
• depth, mm/in	120/4.72
Power consumption, W	no more than 2

1.6 Package contents

	Sigrand SG-17B	Sigrand SG-17BP
Modem	1 pc.	1 pc.
Power supply unit	1 pc.	no.
Certificate	1 pc.	1 pc.
USB-miniUSB cable	1 pc.	1 pc.
Package	1 pc.	1 pc.

1.7 Operation conditions

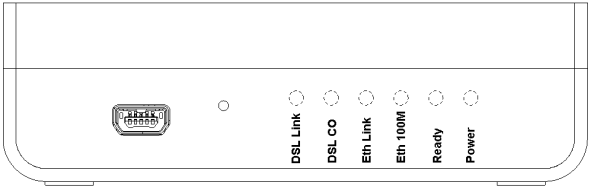
The modem is designed for indoor usage with the following climatic conditions:

Air temperature	10 .. 80º C
Relative air humidity	up to 85 %
Air pressure	84 .. 107 kPa

1.8 Appearance, use of indicators and connectors
1.8.1 Front panel

Indicators on the front panel of the modem show the status of device operation.

Figure 1



Purpose of the Sigrand SG-17B connectors

Table 3

Modem management connector	**miniUSB**

Purpose of the Sigrand SG-17B indicators

Table 4

Indicator	Status	Explanation	
POWER			
POWER	On	Modem is on	
	Off	Modem is off	
Ready	On	Modem operates properly	
	Off	Modem not operate properly(1)	
ETHERNET			
LINK	On	Ethernet connection active	
	Off	No Ethernet connection	
	Blinking	Data exchange	
100M	LINK горит	On	100-Base-TX link detected
		Off	10Base-TX link detected
DSL			
LINK	On	Remote modem link active	
	Blinking	Linking to a remote modem in progress	
	Off	No link to a remote modem	

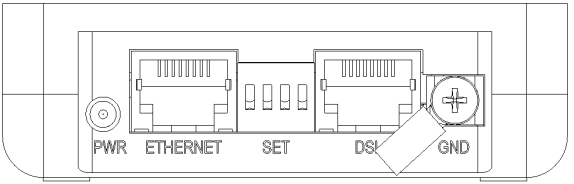
CO	On	Master (CO) mode
	Off	Slave (CPE) mode

1. If indicator **Ready** has not lit up in 1-2 minutes after inclusion of the modem, the modem is not serviceable.

1.8.2 Rear panel

Layout of connectors and switches on the rear panel of the Sigrand SG-17B modem:

Figure 2

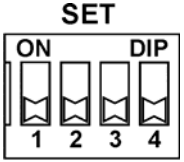


Purpose of the connectors and switches of the Sigrand SG-17B modem

Table 5

Power supply unit plug	**PWR**
Ethernet 10/100Base-T socket	**ETHERNET**
DIP switches to set up modem operation mode	**SET**
DSL line connector	**DSL**
Terminal to connect to protective ground	**GND**

Figure. 3



The “SET” DIP switch selects Master/Slave mode (SET 1) and the xDSL channel rate.

Attention!
*Reboot the modem or use the **retrain** command to activate a new operation mode, enabled by the DIP switches!*

2. Setting up the modem

2.1 Connecting modem to a line

Make sure the line has no foreign devices varying its specifications such as fuses, inductors, load coils and other similar line conditioning devices. These devices may cause serious modem performance limitations or even completely prevent operation of an xDSL modem!

Make sure that the communication line in use has neither external voltage supply nor attached foreign telecommunication devices! Ignoring this rule may cause permanent damage to both the modems and the foreign telecommunication equipment!

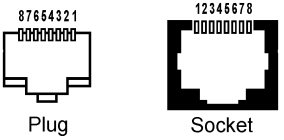
2.1.1 Communication line requirements

The line should comply with the following requirements for proper operation and performance:

- The cable must have leakage neither to ground nor to other wires (both connected and loose). The cable must not have taps (branches).
- Both wires must belong to the same twisted pair if a multi-pair cable is used.
- Parallel connection of several pairs (for example, to reduce the line resistance) is not allowed.
  Violation of the aforementioned requirements may significantly reduce the modem performance or even completely prevent operation of a xDSL modem. After you make sure the line meets the aforesaid requirements proceed to the following steps:

- Fix the supplied RJ-45 plug on the cable as shown on Figure 4. The Sigrand SG-17B modem uses only one pair of pins, namely 4 and 5. Other pins are not assigned.
- Attach the cable to the DSL connector of the modem.

Figure 4.



2.2 Choosing the method of modem management

The modem may be managed in the following two ways:

- With the DIP-switch on the rear panel of the modem (Fig.3);
- With a terminal program via the USB port (see chapter 3).

Both options have certain advantages and the user may choose the way of modem management depending on the operation conditions.
The management method via DIP switches is described here as the most simple. Management method via a terminal program is described in chapter 3.

2.3 Master/Slave mode

Two modems operating peer-to-peer must be configured by the SET DIP switch (fig. 3, table 5) so that one modem is set up as a Master (Master, CO) and another one as a Slave (Slave, CPE). We recommend setting the more accessible for management and maintenance modem as the Master. To set up the modem as the Slave all switches should be **OFF**. Otherwise the modem will be set up as the Master.

2.4 Setting the transfer rate

Fixed rate value is set by dial switch SET (Fig. 3, Table 6). One of 16 fixed data rates may be selected. The sticker on the bottom of the modem may be used as a hint.

Table 6

SWITCH				Rate, kbps
1	2	3	4	
Slave Mode (CPE)				
off	off	off		
Master Mode (CO)				
ON	off	off	off	256
off	**ON**	off	off	384
ON	**ON**	off	off	512
off	off	**ON**	off	768
ON	off	**ON**	off	1024
off	**ON**	**ON**	off	1536
ON	**ON**	**ON**	off	2304
off	off	off	**ON**	3072
ON	off	off	**ON**	3840
off	**ON**	off	**ON**	4608
ON	**ON**	off	**ON**	5696
off	off	**ON**	**ON**	7168
ON	off	**ON**	**ON**	9296
off	**ON**	**ON**	**ON**	11520
ON	**ON**	**ON**	**ON**	14080

2.4.1 Setting rate for remote modem

We recommend setting up a remote modem in the Slave mode (all switches should be **OFF,** see Table 6).

The Slave modem tunes automatically to the DSL speed set on the Master modem.

*Do not forget to turn **OFF** the switches of the remote modem beforehand!*

2.4.2 Rate choice recommendations

Before setting the data rate you must know the performance of the line the modems are intended for. If the line performance is unknown, follow these steps to select the proper data rate:

- Measure the resistance of the line: make short-circuit on one side of the line and attach an ohmmeter to another side. Using Table 2 calculate the maximum rate that gives stable communication.
- Choose the appropriate rate with the **SET** switch (see Table 6, Fig.3). Reboot both modems to activate the new settings. Set up only the modem in the Master mode. The modem in the Slave mode will be set up automatically. Link activation takes up to 2 or 3 minutes.
- If the link is not activated (the DSL LINK LED does not light up) within the mentioned time, set a smaller value on the **SET** switch and try to activate the link again.
- If you can't get the link activated, consider to use console management mode (Operating the modem with a console). In this mode you may try to vary the line coding type as well (Table 7).

3. Operating the modem with a terminal

The Sigrand SG-17B modem management is possible via a computer with a terminal program installed.

3.1 Setting up the terminal

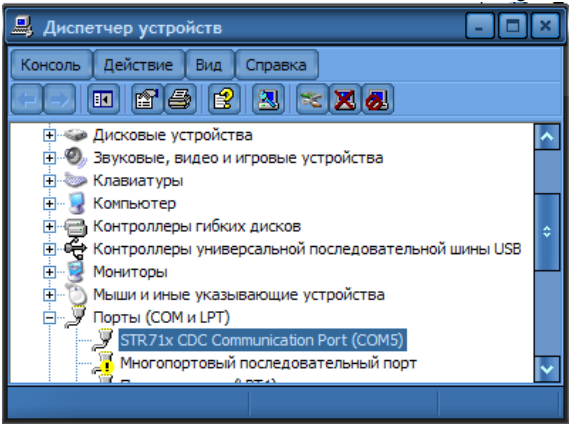
Set all SET switches to OFF position to operate the modem with a terminal (Table 6, Fig. 3).

3.1.1 Setting up the terminal for OS Windows

Connect the modem to your computer through the USB port. “A new device was found”-window will pop up. Now you have to install the **stmcdc.inf** driver on your computer (find the driver on the supplied disk). After the

driver has been installed go to **Start > Control Panel > System > Hardware > Device manager.**
If the installation was correct you will see the new device as in Fig.5:

Figure 5



Pay attention to the number of the successive port, given to the modem by the system.
Launch HyperTerminal or its analogue and configure the COM-port of the modem with the following characteristics:

Rate: 115200
Data bits: 8
Parity: None
Stop bits: 1
Flow control: None

After the configuration is completed close HyperTerminal and switch the modem off. Next, switch the modem on and launch HyperTerminal again.

In the opened HyperTerminal window press **Enter**. If the settings are correct you will see the following prompt window:

```
>
```

3.1.2 Setting up the terminal for OS Linux

Install a terminal program minicom beforehand to control the modem in OS Linux. In Ubuntu or Debian distributives run:

```
#apt-get install minicom
```

Connect the modem to the computer via the USB port, than execute:

```
#dmseg | grep ttyACM
 cdc...acm 5-2:1.0:ttyACM0: USB ACM device
```

Here we are using the ttyACM0 device for terminal. Launch minicom:

```
#sudo minicom
```

On the keyboard press the key combination **CTRL-A+Z** and then press **O**. You will see the configure menu. In this menu choose "**Settings serial port**" and set the following characteristics:

A- serial port: /dev/ttyACM0
B- lock-file : /vat/lock
C- program at input:
D- program at start:
E- Rate / Parity / Bits : 115200 8N1
F- Hardware control stream: Yes
G- Program control stream: No

After configuration is finished press **Esc** twice to exit the menu. On the keyboard press **CTRL-A+Q**. If the configuration was done properly you will see the following prompt window:

```
>
```

3.2 Management commands

The modem is operated by a set of commands conventionally divided into two types: “general purpose” commands such as **help, info, reboot** nd management commands such as **rate**, **tcpam**, etc.
The console management mode allows configuring the DSL interface, watch status of the interfaces, etc. The summary of the general management capabilities can be invoked by the **help** command:

```
> help

*****************************Help menu*******************************
master | slave              - set modem mode: master(CO) or slave(CPE)
annexA|B                    - G.SHDSL.bis Annex type
tcpamXXX                    - line coding, XXX={16,32,64,128}
rate <value>                - line rate
plesio | plesio-ref | sync  - Plesiochronous/Plesio-Ref/Synchronous
                              modes
pbo-normal|pbo-forced <val> - Power Backoff mode, <val> - value in dB
cfg                         - Inquiry configuration
stat                        - Inquiry statistic
info                        - Info modems
reboot                      - Reboot modems
retrain                     - Retrain lin
*********************************************************************
```

The **info** command displays information about the firmware version:

```
> info

Sigrand SG-17B v. 1.0
Firmware MC: SG-17B v.1.0
Firmware IDC: v1.1_1.4.18
```

```
Firmware SDFE: v11.158.003
Firmware IAP: v1.0 UART
>
```

The **reboot** command reset of the modem:

```
> reboot
Sigrand SG-17B v.1.0
Firmware version: SG-17B v.1.0
Initialization.....
Initialization complete
Configuration......
Configuration complete
```

If the command is unknown the following message appears (as an example we typed **sfd**):

```
> sdf
Command not found: sdf
>
```

3.3 DSL interface management

The DSL interface is set up by the following commands:

```
master | slave              - set modem mode: master(CO) or slave(CPE)
annexA|B                    - G.SHDSL.bis Annex type
tcpamXXX                    - line coding, XXX={16,32,64,128}
rate <value>                - line rate
plesio | plesio-ref |sync     - Plesiochronous/Plesio-Ref/Synchronous
modes
pbo-normal|pbo-forced <val> - Power Backoff mode, <val> - value in dB
```

3.3.1 Master/slave mode option

Configure one peer modem as Master and the other one as Slave for proper operation. This is done by the **master** or **slave** commands respectively.

```
> master
Configuration......
Configuration complete
>
```

```
> slave
Configuration......
Configuration complete
>
```

We recommend setting the more accessible for management and maintenance modem as the Master (CO).

3.3.2 DSL rate setup

The data rate should be set only on the Master modem. The Slave modem will adjust automatically.

The rate setup is performed by the **rate** command and the **<value>** option **(<value>** stands for rate in kbps). The rate is within 192 to 15296 kbps range with 64 kbps step:

```
> rate 15296
Configuration......
Configuration complete
>
```

The Slave modem obtains the rate via G.hs Preactivation (ITU-T G.994.1) protocol from the Master modem.

3.3.3 Line coding option

TCPAM line coding is used by the G.991.2 (G.SHDSL) standard modems. This coding has several versions which differ in the coding algorithm complexity. Higher transmission rates correspond to the mode with a larger number of modulation positions (TCPAM64, TCPAM128), while modes with

few modulation positions are used for lower rates (TCPAM16, TCPAM32). Thus, the more complex the coding algorithm, the worse the noise immunity of the channel is and vice-versa.
Therefore it is important to pay special attention to the TCPAM coding algorithm while configuring the line rate and, if necessary, to adjust the line code for better results. Table 7 shows the correspondence between coding options and the data rates

Table 7

Line coding	Data rate range, kbps
TCPAM128	5696 – 15296
TCPAM64	256 – 8192
TCPAM32	192 – 6144
TCPAM16	192 – 3840

The **tcpamXXX** command provides a way to select a line coding mode, where **XXX** stands for one of the 4 available modes: TCPAM128, TCPAM64, TCPAM32 and TCPAM16. This allows selecting a proper mode according to ratings of the line.

```
> tcpam128
Configuration......
Configuration complete
>
```

➔ *As follows from Table 7, many data rates allow using multiple line coding modes. Rule: apply a coding mode with less positions (TCPAM16, TCPAM32) on a line exposed to high level of noise; apply a coding mode with more positions (TCPAM64, TCPAM128) if the bandwidth is limited.*

If the data rate is not within the permitted range for an entered line coding mode, you will see a message with recommendations on coding suitable for the given rate.

3.3.4 Setting up additional DSL specifications

To set up the modem synchronization mode use **plesio, plesio-ref** and **sync** commands.
We recommend the **sync** mode if two SG-17B modems form the communication path (SG-17B<->SG-17B).
The **pbo-forced** command and the **<val>** option (**<val>** stands for the value of Power Backoff rated from 0 to 30) allow setting the level of DSL line Power Backoff in decibels (dB). The **pbo-normal** command sets the mode of Power Backoff to automatic.

All abovementioned commands can be called up individually or together in one line. For example:

```
> master annexA  tcpam128  rate 14080 sync pbo-normal
```

3.3.5 Modem configuration

The **cfg** command shows the current configuration of the modem:

```
> cfg
Current configuration:
master Annex A TCPAM128 sync rate=15296 pbo-normal
>
```

3.3.6 Link statistics

Use the **stat** command to view link statistics:

```
> stat

SNR_Margin: 2dB, Loop Attenuation: 27dB, Power Backoff: 2dB
ES_count: 0, SES_count: 0, CRC_Anomaly_count: 0, LOSWS_count:
0, UAS_Count: 0, Loss_Count: 0
>
```

SNR_Margin – loop/noise margin;

Lopp Attenuation – loop loss (attenuation level), dB;
Power Backoff – reduce output power by this value, dB;
ES_count – number of second intervals, within which one or more CRC anomalies or more than one LOSW Defect were detected;
SES_count – number of one-second intervals, within which no less than 50 CRC anomalies or more than one LOSW Defect occurred (50 CRC anomalies per second correspond to 30% of incorrect frames for a frame of standard length);
CRC_Anomaly_count – number of CRC anomalies detected within the monitoring time;
LOSWS_count – number of second intervals with more than one LOSW Defect detected;
UAS_count – number of second intervals when SHDSL channel was inaccessible. The channel is considered accessible after a failure, if no SES was detected within 10 seconds. The 10 seconds are excluded from the total time the channel was out of inaccessible.

The statistics counter clears after every request.

3.3.7 Connection retraining

The **retrain** command performs the retraining of the DSL interface:

```
> retrain
```

Warranty and liability

The Modem is warranted by the Manufacturer to be free from defects in materials and workmanship. This warranty is valid only if the Purchaser has used and maintained the Modem in accordance with the operating and maintenance directions given in the User's guide. This warranty is not valid if the Modem has been subject to misuse, negligence, accident, fire or other casualty. This warranty is valid within 5 (five) years from either the purchase date as marked on the Warranty Coupon or the stated manufacturing date if the purchase date has not been marked. Subject to conditions and limitations set forth above and below, the Manufacturer will, at its option, either repair or replace the Modem that prove defective of improper workmanship or materials. The Manufacturer shall in no event be liable for any consequential, indirect damages or expenses, lost revenues, lost profits, or any other incidental or consequential damages arising from the purchase, use or inability to use the modem, even if the Manufacturer has been advised of the possibility of such damages.

Warranty limitations: Warranty is void for modems operating on wires having aerial sections.

MANUFACTURER ADDRESS
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pr. Lavrentieva 6/6
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Tel.: (8-383) 332-94-37
Fax.: (8-383) 332-02-43
www.sigrand.com

WARRANTY COUPON
For Sigrand SG-17B modem

Serial number _____

MFG date ____/____/20___ (day/month/year)

Quality checker_____/_____/

Stamp

Seller	
Address	
Phone	
Sale date	
Stamp	
Signature	

Purchaser	
Address	
Phone	
Purchase date	
Stamp	
Signature	

Appendix A

GENERAL SPECIFICATIONS OF TPP CABLE

Table I.1 Frequency response for twisted-pair cabling with copper conductor and PE-insulation (for reference only)

f. kHz	Primary ratings			Secondary ratings	
	R~, W/km	L, H/km*10^{-4}	G,S/km*10^{-4}	|Z|, W	a, dB/km
Conductor diameter 0.4 mm (26 AWG)					
20	278	5.51	1.13	225.2	6.81
50	280	5.51	4.24	152.6	9.12
100	283	5.50	11.3	125.7	10.3
250	316	5.46	42.2	113.7	12.2
500	394	5.35	120	110.5	15.6
700	455	5.26	188	109.1	18.2
1000	535	5.15	305	107.7	21.7
Conductor diameter 0.5 mm (24 AWG)					
20	181	5.50	1.13	185.1	5.15
50	182	5.50	4.24	133.3	6.48
100	189	5.49	11.3	118.0	7.17
250	234	5.40	42.2	111.6	9.21
500	310	5.23	120	108.8	12.4
700	361	5.26	188	107.4	14.6
1000	424	5.04	305	106.3	17.2

Table I.2 Cable loop resistance to conductor diameter ratio:

Conductor diameter (mm)	Loop resistance (W/km)
0.32	432
0.4	278
0.5	180
0.64	110