Technical Description

Digital DCF77-Signal-Analyser with LCD Display

4427

Safety information

The Safety Instructions and Technical Data serve to ensure trouble-free operation and protection of operating personnel and equipment. Strict compliance with these instructions is therefore necessary.

Failure to comply with these Safety Instructions will VOID the Warranty and any claims made under its terms.

Further no liability will be assumed by ***hopf*** Elektronik GmbH, for ensuing consequential damages, resulting from non-compliance.

Safety of the Devices

This instrument has been manufactured in accordance with the latest technological standards and acknowledged safety regulations.

The instrument should only be operated and maintained by properly trained and qualified technical personnel.

Please ensure that all cable connections are laid and fixed in position correctly. The instrument should only be operated with the supply voltage indicated on the identification plate. Note that multiple input power options exist (factory installed).

If an instrument must be opened for repair, this should only be carried out by technicians or engineers with corresponding qualifications or by ***hopf*** Elektronik GmbH company, or its representatives.

If the maintenance work requires the opening of a device or if a fuse needs changing, the device must first be disconnected from all power supplies.

If there are reasons to believe that the operational safety can no longer be guaranteed the device must be taken out of service and labeled accordingly.

The safety may be impaired when the device does not operate properly or if it is obviously damaged. Contact your local ***hopf*** Elektronik GmbH representative for required action.

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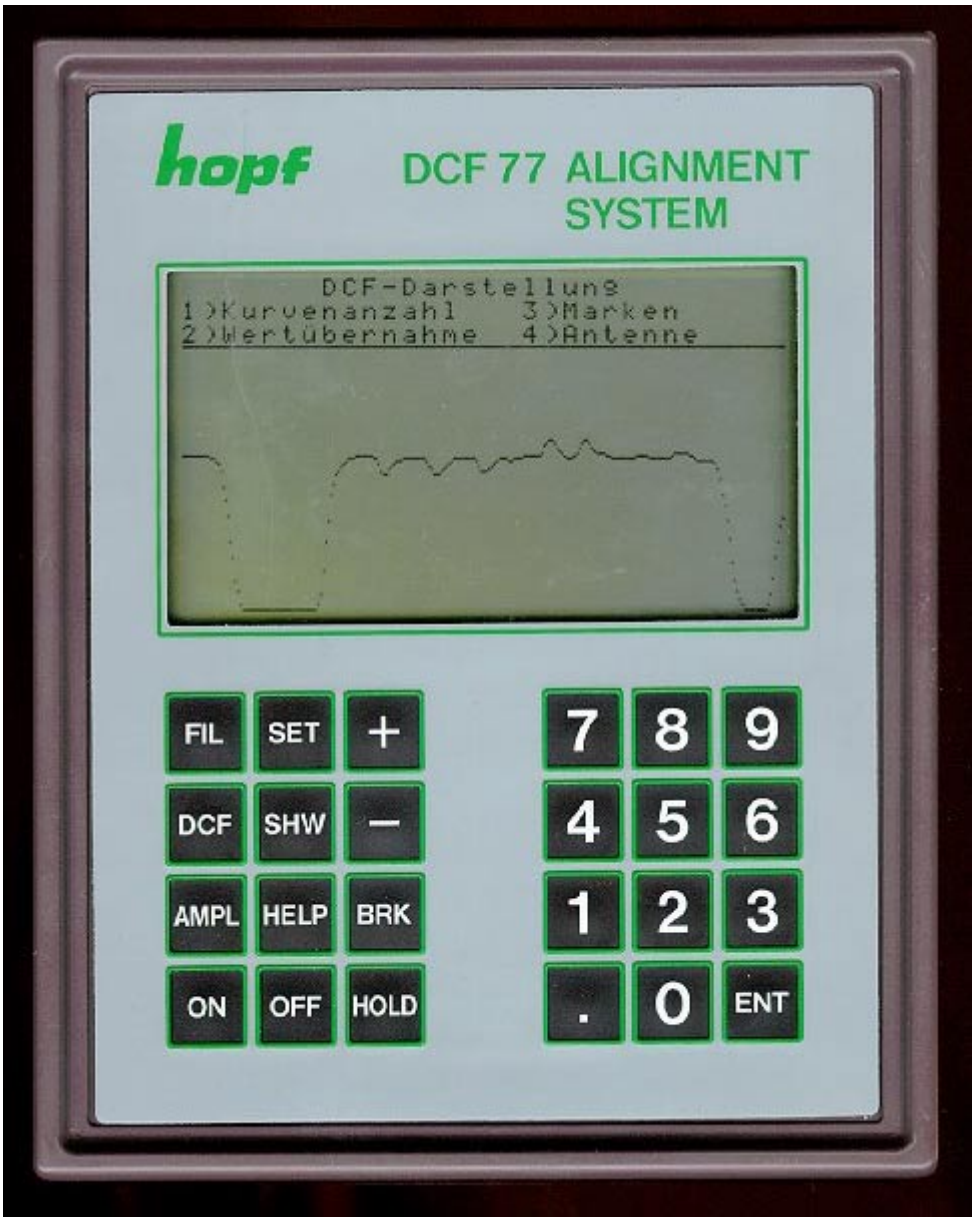
1 Introduction

The signal-analyser was developed to detect possible interferences with the DCF77 signal, causing errors in the time data string. It is almost impossible to synchronise the internal clock with a faulty time data string due to a micro-processor which checks the received time data string in ***hopf*** radio controlled clocks. However frequent interferences - and therefore no synchronisation - block the basic function of the clock.

With the help of the signal analyser it is now possible to receive and inspect the DCF77 signal directly. It is also possible to connect the antenna of the ***hopf*** radio controlled clock which is to be checked to the signal analyser, enabling the user to inspect the DCF77 signal which is decoded by the respective clock.



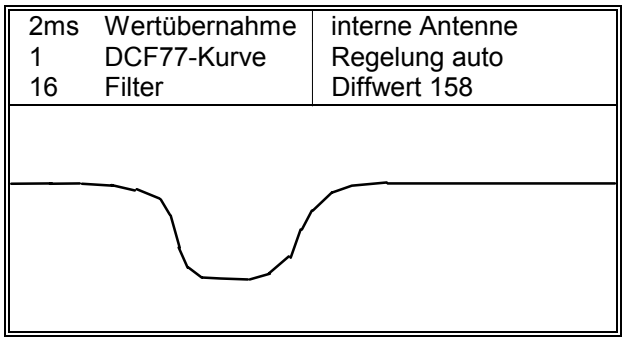
picture 1 (DCF77 Alignment System)

2 Set-up

To switch the device on use the **ON**-key. The status display shows in the top third of the screen the most important settings of the signal analyser. The SHW key always takes you back to this display. Once the DCF77 signal is lined-up it is shown in proportion to the display area on the remaining part of the screen. The standard display shows the following functions:

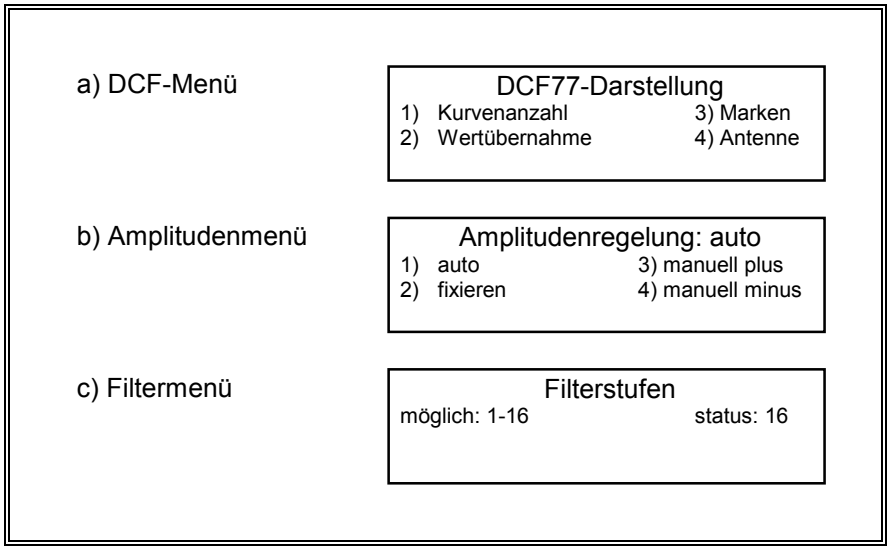
- reception by means of internal antenna
- plot of the 16th filter level
- taking over of DCF77-values every 2 ms
- diagram of a curve
- automatic amplitude control

If the device has been aligned to Frankfurt a.M. correctly the display should look as follows:



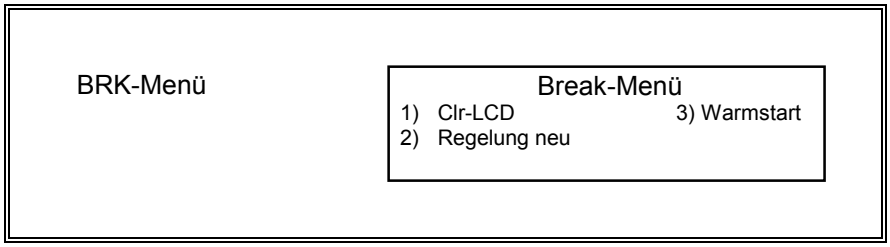
picture 2.0.1 (status display of the signal analyser)

The basic settings can be altered, carried out in different menus, to enable you to control the alignment of the device and to carry out a better evaluation of the DCF77 signal. In total three menus are available i.e. **DCF77-Menu** (DCF-Menü), the **amplitude-menu** (Amplitudenmenü) and the **filter-menu** (Filtermenü). These are called-up by the keys **DCF**, **AMPL** or **FIL** and look as follows:



picture 2.0.2 (main menu of the signal analyser)

These three menus can be complemented by the **BRK menu** (Break-Menü). Here it is possible to delete the LCD display (menu item 1) to restart a control (menu item 2) and to release a complete reset of the device (menu item 3).



picture 2.0.3 (break menu of the signal analyser)

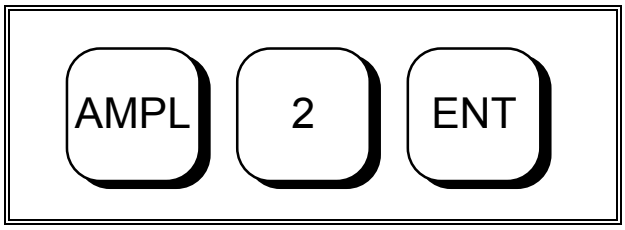
2.1 Alignment of the Signal Analyser

The device must be installed at a right angle to the DCF77 transmitter. The front side of the housing should therefore point directly to the location of the transmitter near Frankfurt a M.

You should switch of the automatic amplitude control after lining up- to be able to check the alignment of the internal antenna. The lining-up can be regarded as finished when the curve in the display only moves fractionally up and down.

If the curve does not resemble the one in picture 2.5.1, or if only an irregular curved line is shown, either the signal analyser is wrongly aligned or there is a strong source of interference nearby. But it is also feasible that the reception of the DCF77 signal is impossible because the device is inside a reinforced concrete building, which can be almost fully HF-proof.

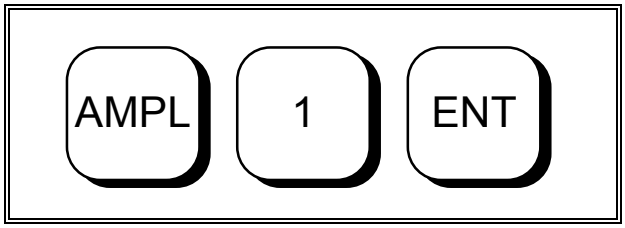
The automatic amplitude control is switched off by selecting menu item 2 - "*fix amplitude*". Started by the following key combination:



picture 2.1.1 (key combination "fix amplitude")

After the automatic amplitude control is disabled, the device must be slowly turned. When the signal decreases i.e. the curve becomes flatter, the device has to be turned in the opposite direction. When the signal decrease once the original position is passed then the initial position was correct and the alignment procedure is finished.

If the signal increases, i.e. the amplitude rises the previously chosen position was not correct. In this case the automatic control must be reactivated in the new position. You do so by selecting "*Amplitude auto"* in the amplitude menu item 1 with the following key combination:

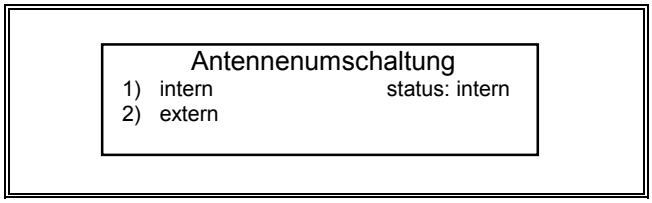


picture 2.1.2 (key combination "automatic amplitude control")

If the amplitude menu is still active, pressing **AMPL** is unnecessary. Once the lining-up is completed the alignment must be checked as described above.

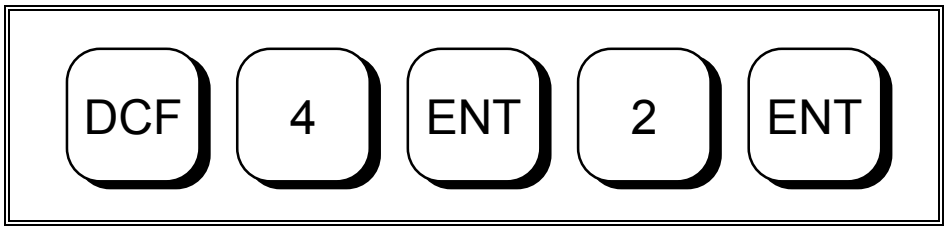
To control the alignment of an external antenna, the BNC-connector on the back of the device must be connected first. It is also necessary to disable the internal reception circuit and to enable the external one. Select the menu item 4 "antenna" in the DCF77 menu to do so.

The following output appears in the menu line:



picture 2.1.3 (antenna menu)

Here item 2 must be selected. The complete combination of keys looks as follows:



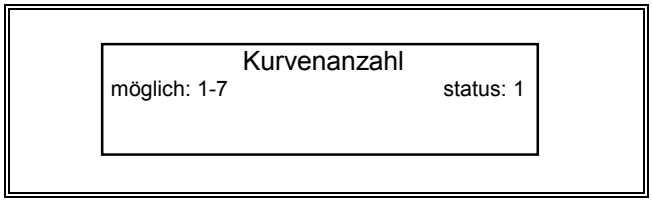
picture 2.1.4 (Combination of keys for the changeover to external antenna)

The menu line must now show the external status. The procedure of checking the alignment of the external antenna is the same as for the internal one. The only difference is that it isn't the signal analyser which is aligned but the external antenna.

2.2 The Evaluation of the Displayed Curve

Evaluating the displayed curve and thus evaluating the received DCF77 signal can be carried out in different ways. E.g it is possible to vary the time span for the take-over of DCF77 values in the display. Values between 1ms and 9ms can be chosen. Value 2 will show the whole DCF77 pulse. 9ms will show two complete pulses. Furthermore it is possible to show several curves at the same time, 7 curves being the maximum.

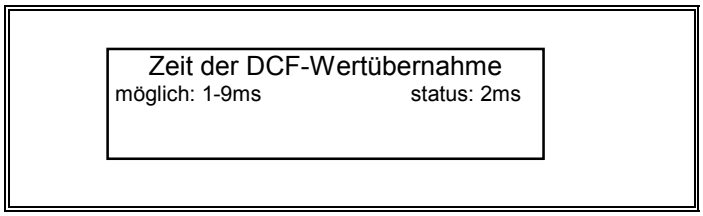
These functions can be set in the DCF77 menu. Press the DCF key to find the DCF77 menu. Select one of the 4 menu items with the corresponding digit key. Menu item 1 serves to set the number of shown curves. Pressing the key 1 and confirming it with **ENT** will result in the following output in the menu line:



picture 2.2.1 (menu item "setting the number of curves")

To set the number of curves select the number and confirm with the **ENT** key.

It is easier to detect persistent failures when the curves overlap. The faults are even easier to find when two instead of one DCF77 pulses are displayed. For this select menu item 2 in the DCF77 menu. The following output is shown in the menu line:



picture 2.2.2 (menu item "Setting of the take-over of DCF77 values")

The menu item 3 "Marker" in the DCF77 menu can be used to show markers in the display. This type of display makes sense only if the value of the time takeover for the DCF77 signal is either 1 or 2 ms. A larger value causes a confusion display due to too many markers in the whole picture.

The automatic amplitude control should be switched off during the whole evaluation of the DCF77 signal. This is done as previously mentioned in the amplitude menu under the item 2 "fixing the amplitude".

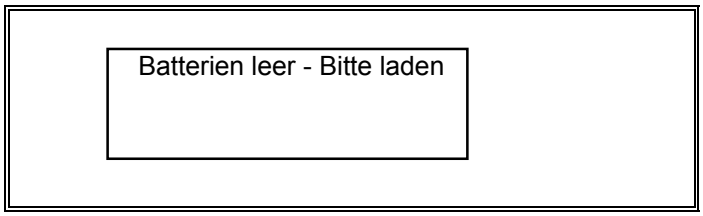
2.3 Further Functions of the Signal Analyser

By means of the filter menu it is possible to display the various filter levels which the DCF77 goes through. Filter 1 represents the first value of the row of filters whereas 16 is the last one.

The "diffvalue" is shown in the main menu i.e. the difference between the maximum and the minimum value of every DCF77 pulse.

The amplitude menu also offers the opportunity to increase or decrease the control value. When this item is selected the control value keeps being increased until menu item 1 or 2 in the amplitude menu is selected. Selecting menu item 2 - **fixing the amplitude** (Amplitudenregelung fixieren) - keeps the new control value. When menu item 1 - **Amplitude auto** (Amplitudenregelung auto) **-** is selected then the automatic amplitude control returns and overrules the manually set control value. It may happen that control of the signal analyser becomes confused. Use the break menu to restart the control.

The signal analyser has a battery controller which causes the following display when the battery voltage falls below a set value:



picture 2.3.1 (menu output when battery control unit is addressed)

The device should be connected to the supplied battery charger. After a charging time of 90 minutes the signal analyser is fully operable.

Once the battery control notifies the device should not be operated for more than 15-20 minutes. The output shown in picture 2.3.1 is repeated every 2 minutes.

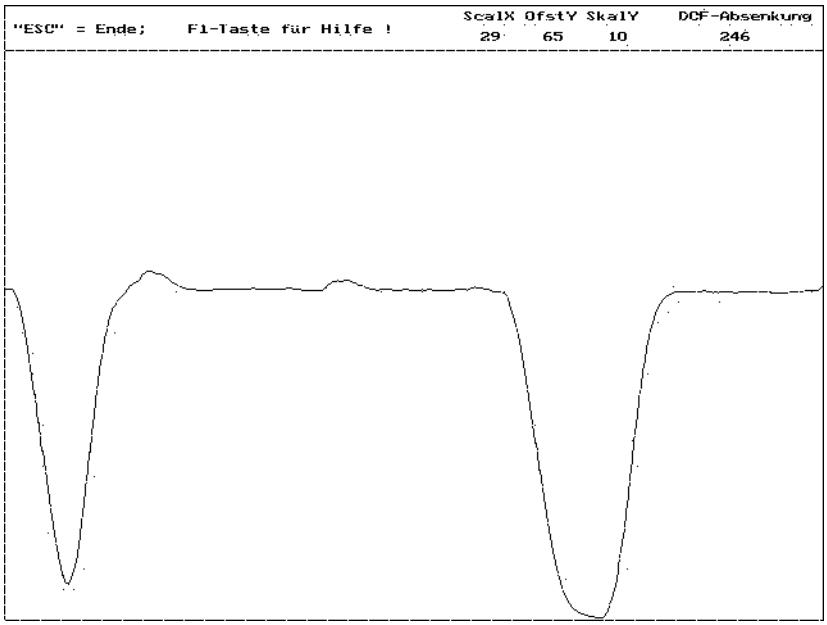
2.4 Error Diagnosis

symptom	*cause*	*remedy*
device cannot be switched on	battery empty	connect device to charger (charging period 90 min.)
no display of the DCF77 signal with external antenna	external antenna is not connected	connect external antenna
	antenna is not aligned to Frankfurt a.M.	align antenna again
	strong sources of interference near antenna	remove antenna from source of interference
	strong source of interference along the antenna cable	relay antenna cable
	antenna is in "HF"- proof building	use outdoor antenna
no display of the DCF77 signal with internal antenna	device not aligned to Frankfurt a.M.	realign device
	strong source of interference near device	remove device from source of interference
	device is inside an "HF"- proof building	use outdoor antenna

2.5 Analysis of the DCF77 Signal

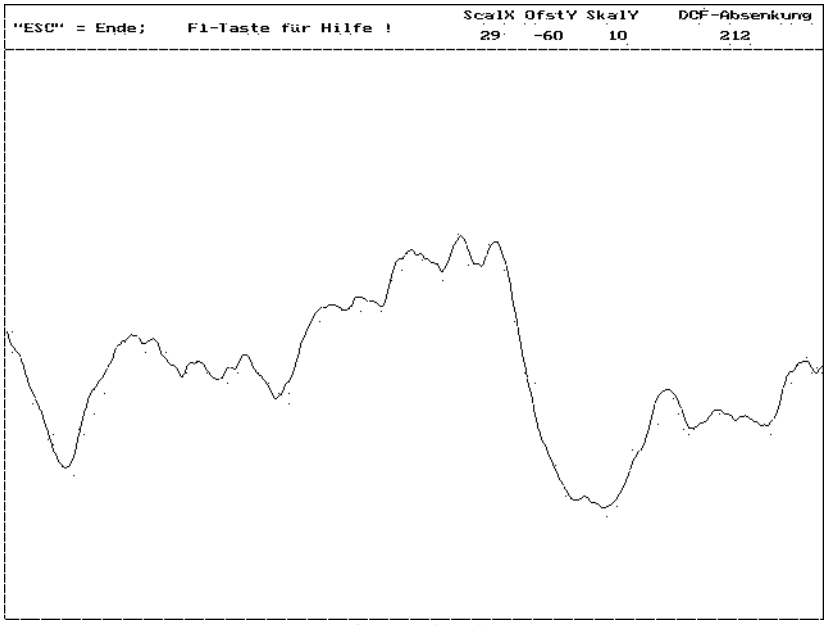
This device can also be used to analyse the DCF77 signal.

Picture 2.5.1 shows an unimpeded reception. The signal dip is clearly to be seen as **zero** and **one** information. The DCF77 signal is not disturbed by foreign sources.



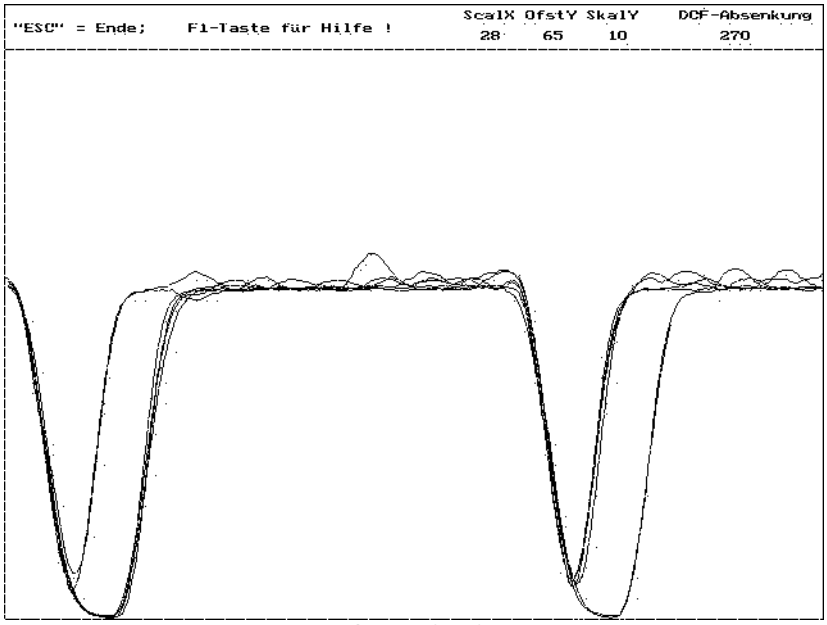
picture 2.5.1

In picture 2.5.2 the antenna is situated near a monitor. The DCF77 signal is superimposed by disturbing frequencies in the same frequency range. A **zero** and **one** information can still be seen at the left and right side of the picture. This does not suffice for an analysis.



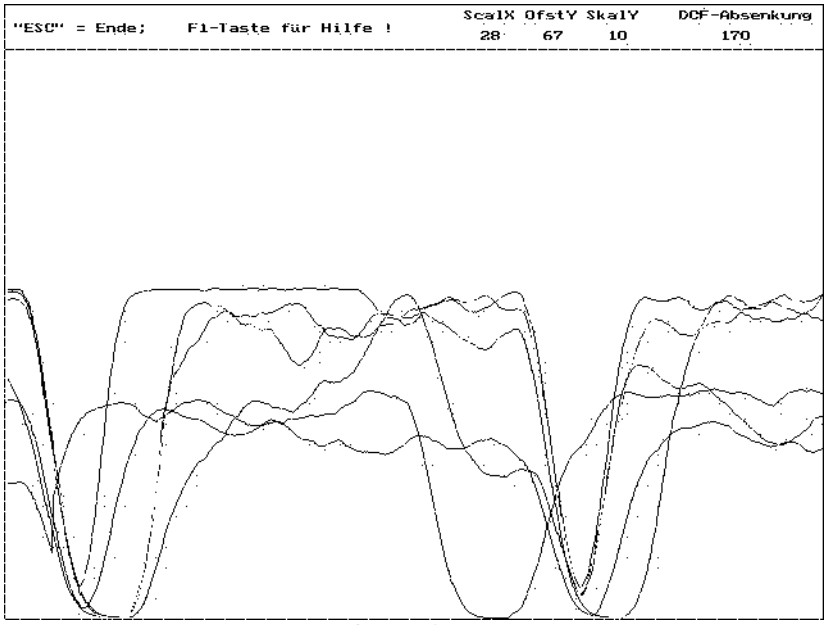
picture 2.5.2

Picture 2.5.3 shows an unimpeded DCF77 signal with 6 sweeps. The **zeros** and **ones** of the DCF77 information are clearly recognisable.



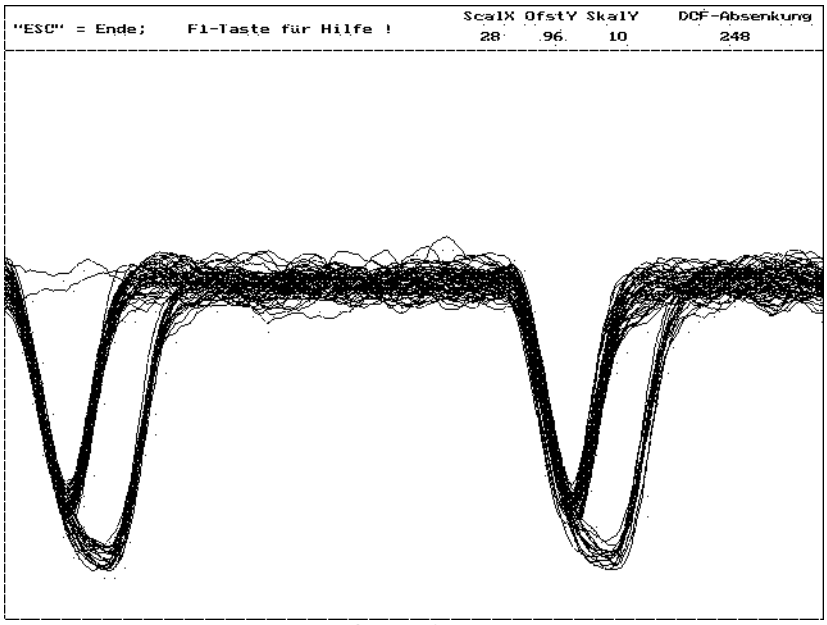
picture 2.5.3

Picture 2.5.4 shows the same , but here the antenna is again placed near a monitor. In this antenna position an analysis is not possible.



picture 2.5.4

Picture 2.5.5 shows a two-minute superimposed pulse recording.



picture 2.5.5

Please Note: TVS AND MONITORS INTERFERE WITH THE RECEPTION. THE ANTENNA SHOULD BE INSTALLED AT LEAST 5-10 METERS AWAY FROM THESE SOURCES OF INTERFERENCE.

3 Technical Data

voltage supply:	5 batteries a 1.2V	
internal voltages:	for logic (Linear controller)	+ 5V
	for LCD-contrast (PWM-switching controller)	– 15V
power consumption:	interface in the shutdown mode	58 mA
	interface active	68 mA
operating time:	5-6 hours	
display:	size of module	59 * 101 * 9,5 mm
	effective display field	126 * 71 mm
	pixel resolution	240 * 128 Pixel
	pixel size	0,47 * 0,47 mm
antenna:	- internal	resonant adjusted ferrite antenna
	- extern	***hopf*** DCF77-antenna connected by BNC-connector on the back of the device
charging via mains unit:	input	240V AC
	output	12V DC / 0,8A
	max. charging time	90 min