SNA-20/-23, SNA-30/33
Spectrum Analyzer

BN 2101/20/23, 2101/30/33
Series B ...

Operating Manual

Wandel & Goltermann
Electronic Measurement Technology

Please direct all enquiries to your local Wandel & Goltermann sales company. The addresses are given at the end of this handbook.

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Addendum to the Operating Manual for SNA-20/23 and SNA-30/33, BN 2101/98.21

This operating manual is valid for the following instruments

SNA-20 Spectrum Analyzer	9 kHz (optional 100 Hz) to 3.2 GHz
SNA-23 Spectrum Analyzer	9 kHz (optional 100 Hz) to 26.5 GHz
SNA-30 Spectrum Analyzer	20 Hz to 3.2 GHz
SNA-33 Spectrum Analyzer	20 Hz to 26.5 GHz
TG-20 Tracking Generator	100 kHz to 3.2 GHz
TG-23 Tracking Generator	10 MHz to 26.5 GHz

All of the SNAs have the same instrument design, user interface and remote control features. The text in the operating manual thus applies to the SNA-20 and SNA-23 Spectrum Analyzers as well as to the SNA-30 and SNA-33. (This is despite the fact that the text mentions only the SNA-20 and SNA-23.)
SNA-30 and SNA-33 are equipped with a high-performance conversion oscillator which gives them even better sensitivity and measurement accuracy than the SNA-20 and SNA-23. This also provides an extended lower frequency limit of 20 Hz. See the data sheets in Chapter 9 for detailed specifications.

October 1994

Contents

1 Introduction

1 Introduction

1.1 Applications

The SNA is a modern, high-performance, portable spectrum analyzer. It has been specifically designed for mobile measurement applications.

Frequency range:	Standard model	With "narrow-band filters" option
SNA-20	9 kHz to 3.2 GHz	100 Hz to 3.2 GHz
SNA-23	9 kHz to 26.5 GHz	100 Hz to 26.5 GHz

– It is suitable for a wide range of measurement tasks in the specified frequency range.
– Detection and analysis of all types of signal encountered in the field of telecommunications
– Measurement of harmonics and intermodulation products
– Measurement of low-amplitude signals that are swamped in noise using the digital averaging function
– It is designed for use in the following areas:
– Low frequency
– Carrier frequency, baseband, intermediate frequency
– Microwave radio
– Satellites

The TG-20 and TG-23 Tracking Generators are companions to the SNA-20 and SNA-23 Spectrum Analyzers. These devices are pure CW sources i.e. no modulation is possible. In conjunction with the SNA-20/SNA-23, the generators make possible a variety of measurements which would otherwise require a network analyzer.

This includes measurements of:
- Transmission (e.g. frequency response of DUTs)
- Reflection
- Gain or loss.

Typical DUTs are two-port networks such as amplifiers, attenuators, filters and combiners.

The SNA supplies power to and controls the TG via the built-in interfaces.

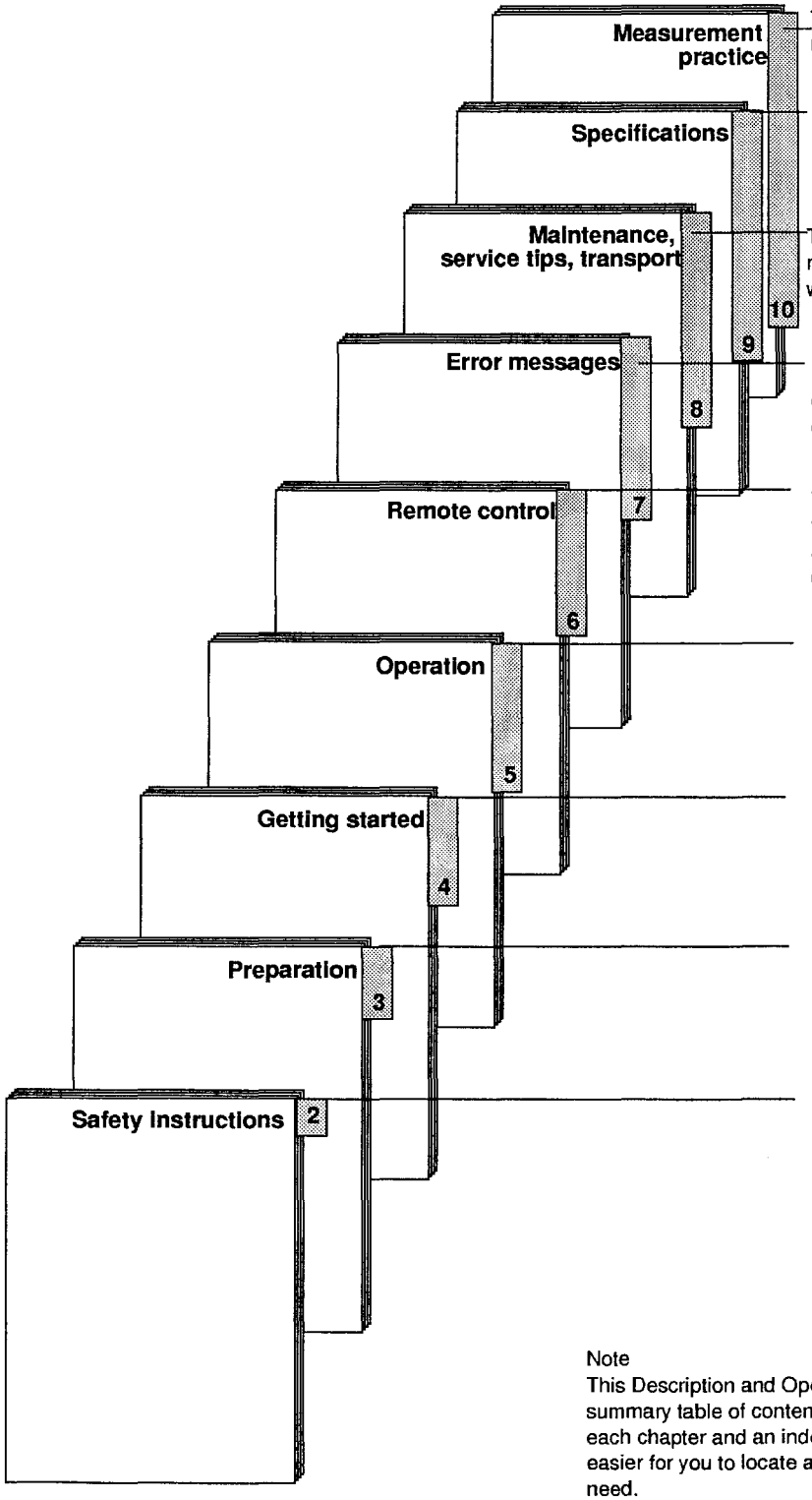
In conjunction with the SNA-20 or SNA-23, the TG-20 allows measurements in the frequency range from 100 kHz to 3.2 GHz. The combination of the TG-23 and SNA-23 covers the frequency range from 10 MHz to 26.5 GHz.

1.2 Instrument characteristics

- Clear user interface
- Low intrinsic noise through fundamental mixer. This means high measurement sensitivity (good signal-to-noise ratio), even with small signals
- If high sensitivity is not essential, a wider RBW can be selected to allow faster sweeping
- Exchangeable precision connector means test objects are extremely simple to connect. Adapters are unnecessary
- High frequency accuracy through the use of a sweepable, phase-locked synthesizer (SPLS)
- Frequency counter for measuring the carrier and modulation frequencies with the time base accuracy
- Outstanding marker accuracy
- Remote control to SCPI
- HD drive for storage of results, tolerance masks and setups; diskettes written in DOS format

1.3 About this Description and Operating Manual

The chart below shows the structure of the Description and Operating Manual, together with the main contents of each chapter.



Note
This Description and Operating Manual contains a summary table of contents, detailed contents lists for each chapter and an index (at the back), to make it easier for you to locate any specific information you need.

This Description and Operating Manual has been drawn up for the following instruments:

- Spectrum analyzer SNA-20/Mitlaufsender TG-20
- Spectrum analyzer SNA-23/Mitlaufsender TG-23

Note: The header line shows to which instruments this description applies. If "TG-20/TG-23" is shown, then special functions of the tracking generator are described on the page. If not, then the page only covers SNA-20/SNA-23 functions

Declarations

The keys, softkeys and identification numbers on the instrument are represented as follows in this Description and Operating Manual:

- Keys: [xxx], e.g. [FCENT]
- Softkeys to the right of the display from top [SF1] to bottom [SF8]
- Softkeys underneath the display from left [F1] to right [F8]
- Identification numbers on the front panel and backplane: [x] , e.g. [52]

The instrument can also be operated using an external keyboard.

Notes:

2 Safety instructions

2 Safety instructions

All the instruments in the SNA family leave the factory intact and in perfect working order. We recommend following the instructions given below carefully, in order to preserve this condition and to ensure absolutely safe operation of the equipment.

2.1 Intended purpose

The instrument must only be used for its intended purpose and under the operating conditions for which it was actually designed. Please also refer to the chapters entitled "Specifications" and "Introduction" in this Description and Operating Manual.

Important: Operating the instrument under any other conditions may result in injury to the user or damage to the equipment; see also section entitled "Defects and damage".

2.2 Connection of measurement circuits carrying dangerous contact voltages

If measurement circuits carrying dangerous contact voltages are to be connected, a protective ground connection must be made first. If the protective ground conductor of the a.c. power supply is able to perform the same role for the measurement circuits, the connection which must be made beforehand is the a.c. line connection.

If a separate protective ground conductor is provided for the measurement circuits, it must be connected to the frame (e.g. to the chassis ground socket) before it is connected to these circuits.

2.3 Defects and damage

If it becomes evident that the instrument can no longer be operated safely, it must be removed from service and prevented from being switched on accidentally. This is the case if:

- ❒ The instrument exhibits visible damage
- ❒ The instrument no longer functions correctly
- ❒ The instrument is subjected to stresses of any kind (e.g. storage, transport) and the permissible limits are exceeded

2.4 Opening the instrument

The instrument must be disconnected from the a.c. power supply and from all other power sources before it is opened. Capacitors inside the instrument may still be charged. Please refer to the circuit diagrams for details.

If it is then necessary to calibrate, maintain or repair the open instrument with the power connected, this should only be done by trained personnel.

2.5 Repairs, spare parts

Repairs

Repairs must be carried out expertly. Special care must be taken to ensure that the design features of the instrument are not altered in any way which affects the safety specifications. In particular, leakage paths, clearances in air and the thickness of insulation materials must not be reduced under any circumstances.

Spare parts

Original parts should normally be used as replacements for defective parts. Other spare parts may only be used if they do not affect the safety specifications of the instrument.

2.6 Tests after repairs and maintenance

Protective ground connection

The protective ground connection must be checked after all repairs and maintenance. The connection itself must be inspected, and the resistance between the protective ground terminal of the a.c. line plug and the frame (chassis ground socket) must be measured. The resistance of the protective ground conductor must be less than 0.1 Ω. The connecting cable must be moved around while the measurement is being taken. If the resistance changes, it is likely that the cable is damaged. In this case, it must no longer be used.

Repeat the measurement with a new cable. If the change in the resistance proves not to have been caused by the cable, the instrument must be withdrawn from service until the true cause has been established, and then remedied in accordance with the safety precautions.

Insulation resistance

The insulation resistance is measured with a 500 V DC voltage present between the a.c. line connections and the protective ground connection. The power switch of the instrument must be set to the "I" position in order to do so. According to the VDE specifications, the insulation resistance should be greater than 2 MΩ. If it is less, the instrument must be removed from service and repaired.

3 Preparation

4 Getting started

3 Preparation

3.1 After unpacking

- ❑ Visual inspection: Make sure the packaging is not damaged.
- ❑ Check that the contents of the box coincide with the data on the dispatch note.
- ❑ Visual inspection: The instrument must not exhibit any external damage. If it does, please consult your local Service Center. You can find out which Service Center is responsible for your area by referring to the list of addresses on the reverse of the inner cover sheet.
- ❑ Packaging: Keep all the packaging components in a safe place. If the instrument needs to be serviced, it should always be returned in its original packaging. The procedure for packing the instrument ready for dispatch is the reverse of that for unpacking it.
- ❑ Check that the power cord is included.
- ❑ The instrument must be set up at room temperature.
- ❑ Read the safety instructions in chapter 2 before using the instrument.

3.2 Setting up the instrument carrying handle

The carrying handle of the SNA can either be used to support the instrument, if desired, or detached from it.

Adjusting the carrying handle

The carrying handle can be adjusted in 90 ° steps or locked into position all the way back. If it is locked in position, it can be released again and adjusted by pressing the two buttons on the handle bearings simultaneously.

Supporting the instrument

To support the instrument on the carrying handle:

- Press the buttons on the bearings of the carrying handle in order to release it
- Raise the instrument at the front
- Lower the carrying handle (it locks in position automatically)
- Place the instrument down on the work surface again

Detaching the carrying handle

To detach the carrying handle from the instrument:

- Press the buttons on the bearings of the carrying handle in order to release it (1)
- Keep the buttons pressed in
- Lock the handle into position by raising it up past the upper locking position almost to the housing cover (2),
- Pull the side sections of the handle outwards (3)
- Remove the handle

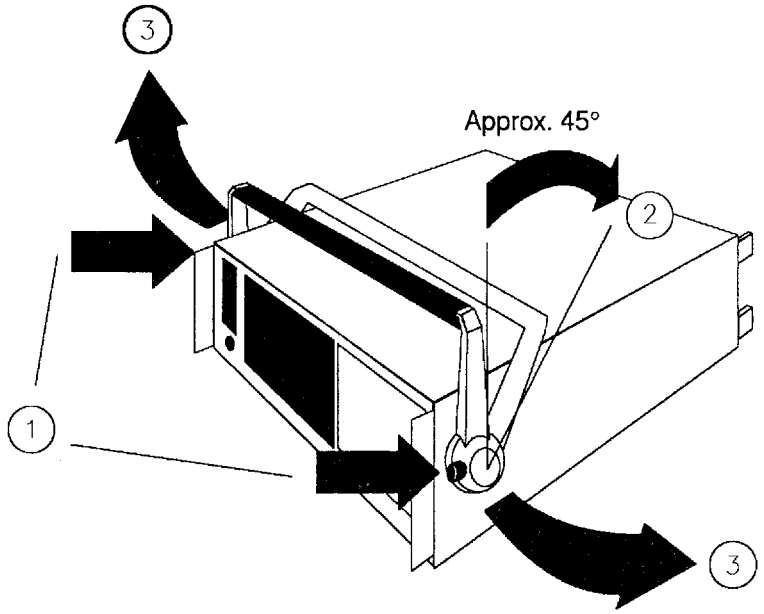


Fig. 3-1 Detaching the carrying handle

Fitting the carrying handle

To fit the carrying handle again:

- Pull the side sections of the handle apart
- Press the two buttons on the handle bearings simultaneously
- Turn the handle to the position shown in Fig. 3-1 (2)
- Release the side sections and the two buttons
- Turn the handle either upwards, forwards or downwards (it locks in position automatically)

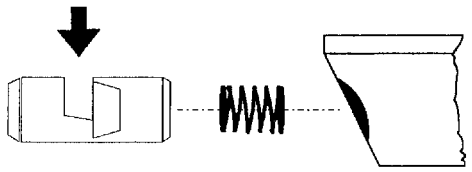


Fig. 3-2 Release button

Note: Since the release buttons and the spiral springs are no longer locked in position when the carrying handle is detached, it may be that they jump out of their guides. If so, they must be reinserted in them before the handle is fitted. Please make sure that the notch in the top of each button is facing the instrument. If it is not, the handle will not latch into place properly.

3.3 Assembling the test port

The test port of the SNA is fitted with a exchangeable connector receptacle for an exchangeable connector. This receptacle is protected by a plastic cap when the instrument is delivered. The connector you specified when placing your order (N or PC 3.5) is packed in a small box.

Note: Take care not to touch the butting contacts of the exchangeable connector. The middle connector must not be damaged under any circumstances. If the exchangeable connector is removed, it must be stored in its original box. Save the plastic cap in case you need it to protect the exchangeable connector receptacle.

Assembly procedure

- Remove the plastic cap from the exchangeable connector receptacle on the SNA
- Remove the N connector from its box, holding the union nut, and carefully insert it in the basic socket on the spectrum analyzer
- Tighten the union nut. The socket insert must be secure!

3.4 Connecting the TG and SNA together

The cables listed below are included with the TG as supplied.

The cables are formed so that the SNA sits on top of the TG. The anti-slip rubber feet ensure stability; no mechanical links are required.

Attention: **Make sure that the SNA is disconnected from the a.c. line and all other voltage sources before connecting the TG and SNA together.**

Connect the two units as follows:

- Place the SNA on top of the TG. It is a good idea to fold the SNA's handle back under the instrument base (press the release button).
- Make the connections shown in the diagram below. The table indicates the connector sockets, cable numbers and functions in more detail.
- Before connecting the LO signal using K 746, remove the 50 Ω terminating resistor from socket [71] of the SNA and fit it to socket [21] of the TG. It is easier to connect K 746 to the TG first and then to the SNA.

When disconnecting, please note:

- The SNA must be disconnected from the a.c. line and all other voltage sources.
- The 50 Ω terminating resistor should be reconnected to socket [71] of the SNA (do not overtighten).

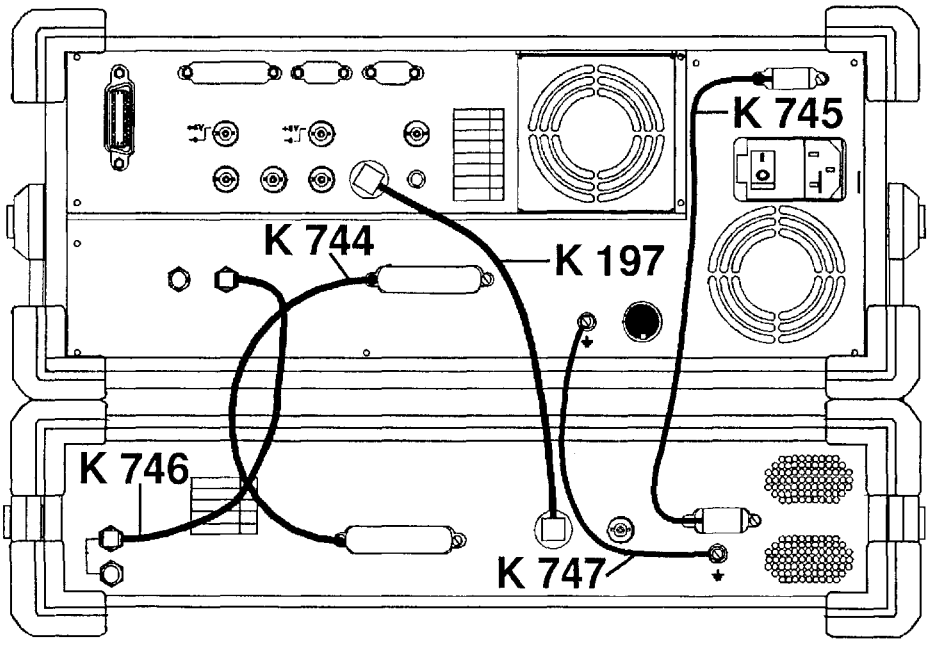


Fig. 3-3 Connections between SNA and TG on the back

SNA socket	TG socket	Connecting cable	Function
[73]	[20]	K 744	INPUT/OUTPUT bus
[71]	[22]	K 746	LO signal; do not overtighten the SMA connector
[64]	[23]	K 179	10 MHz reference frequency
[76]	[25]	K 745	TG power supply
Ground socket	Ground socket	K 747	Ground connection

Fig. 3-4 connector sockets, cable numbers and functions

3.5 Before switching on

Note: The instrument conforms to safety class I; the cover (frame) is connected to the protective ground conductor.

- A.C. line operation: The a.c. line connection incorporates a protective ground conductor. The enclosed power cord must be used.
- The cables which are used - especially the power cord - must be intact.

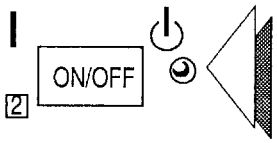
Power supply

The instrument is supplied with power by a switched-mode power supply which automatically switches between two voltage ranges. The a.c. line connector, the power switch and the fuse are all located on the instrument rear.

3.6 Switching on the instrument

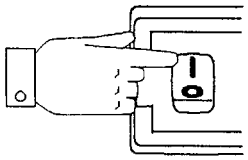
The instrument has two possible operating modes:

STANDBY (the green LED next to the ON/OFF switch on the front panel lights up and the display is blank)

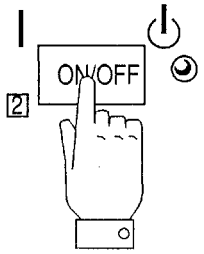


Measurement (the green LED next to the ON/OFF switch on the front panel is off and a measurement or a menu is visible on the display)

1. Press the power switch on the rear.



2. If the instrument is set to standby mode, press the ON/OFF switch. The green LED goes out and a power-on test routine starts.



3.6.1 Power-on test routine

This routine tests the RAMs, ROMs, I/O channels, timers and display controller board. Initially, all the LEDs on the front panel light up as well. The keyboard and the hardware setups are checked.

Power-on test errors

If an error is detected during the power-on test, either one long audible signal or several short signals are output. If one of the memory chips is defective, the words "ROM ERROR NO." or "RAM ERROR NO." appear on the display, together with the number of the defective EPROM or RAM. Please refer to the Service Manual for further details.

Test successful

If no errors are detected, the test is acknowledged by means of a short audible signal. The USER PRESET is then set, see 3.7.1. If no USER PRESET is defined, the settings defined in the DEFAULT PRESET are used. Afterwards, the SNA calibrates the set resolution bandwidth and amplitude display.

3.6.2 Instrument undertemperature

A temperature sensor is integrated in the instrument. If the instrument temperature falls below the permissible limit, the instrument will be switched on nevertheless, but the measurement CPU will be blocked. The CPU is started up when the instrument returns to the permissible temperature range, e.g. as a result of the heat which is dissipated by its components.

3.6.3 Automatic disconnection of the instrument

3.6.3.1 Overtemperature

A temperature sensor is integrated in the instrument. If the temperature inside the instrument becomes too high (e.g. as a result of an abnormally high ambient temperature), the power supply unit is switched off automatically. It cannot be switched on again until the temperature inside the instrument returns to the permissible range.

3.6.3.2 Undervoltage/overvoltage

The built-in power supply unit operates in two voltage ranges; it is switched off automatically if the a.c. line voltage is outside these ranges. The unit is automatically switched back on in the previously set mode when the a.c. line voltage returns to the permissible range.

3.7 Parameter presets, PRSET key

When first powered up, the SNA assumes the basic setting which was defined as a preset parameter. Two presets are available:

Default Preset: In ROM (drive C:), the basic parameter settings listed in section 3.6 are stored as setup 1.

USER Preset: You can specify your own basic parameter settings and store them. The USER PRESET can be defined exclusively in SPECTRUM ANALYSIS mode. However, the preset also includes the selected printer or plotter and the selected interface as set in the CONFIGURATION menu. You can thus be certain that when you press the PRESET key, you're getting instrument settings which make sense for you.

3.7.1 USER PRESET

If a USER PRESET is defined, its settings are available automatically after power-on. These settings are also made by pressing the PRESET key.
If no USER PRESET is defined, the settings of the DEFAULT PRESET are used.

3.7.1.1 Defining and storing the user preset

Set the desired parameters
- In the main menu and in the related submenus
- In the configuration menu and in the related submenus (printer type, interface).

- Press the **[USER MEM]** key.
- Press **[SF4] RAM (B:)** to display the contents of the read/write memory.
- Press **[SF7] SAVE PRESET** to store the user preset.

Note: The USER PRESET is not indicated in the user memory.

3.7.1.2 Calling up the user preset

3 Press the **[PRSET]** key. **PRSET** invokes the standard settings of the SNA, setting all parameters and functions to the values chosen by you. The interface and the printer or plotter type are simultaneously set as defined in the user preset. If no user preset is stored, the parameters are set as described in section 3.7.1 .

3.7.2 DEFAULT PRESET

3.7.2.1 Calling up the default preset

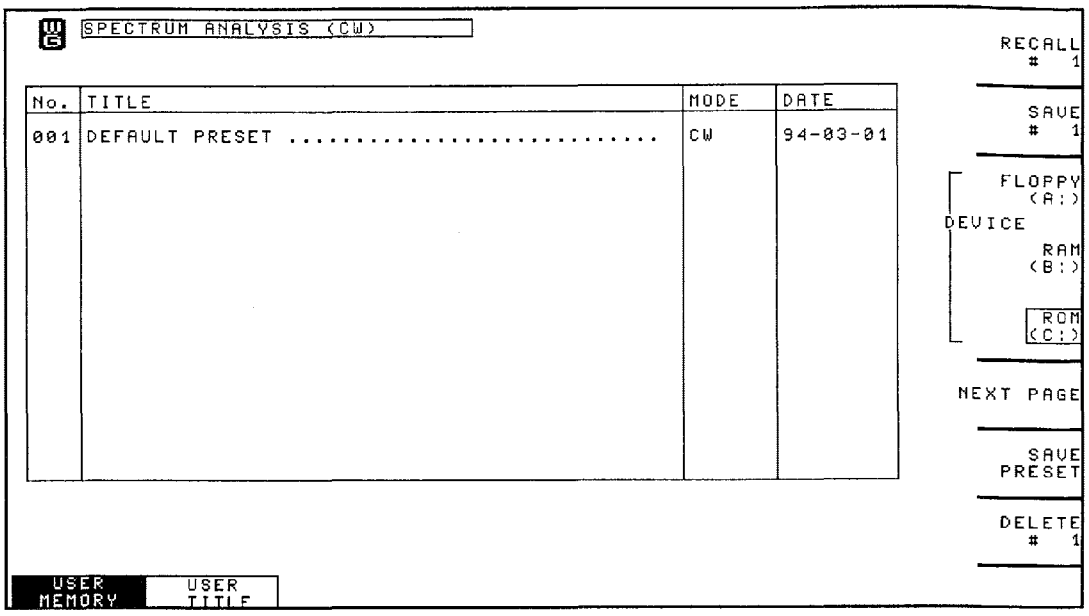


Fig. 3-5 The default preset from W&G is stored in drive C: as setup 1

- Press the **[USER MEM]** key.
- Press **[SF5] ROM (C:)** to display the content of the read-only memory.
- Press **[SF1] RECALL** to input the setup to be called up.
- Press the **digit 1** followed by the ENTER key to call up the default preset. You can restore the default preset as the user preset at any time.

The analyzer parameters can be preset at any time during operation with the "PRSET" key. These presets are then saved.

They can be retrieved from the memory by pressing the "PRSET" key and selecting the "SPECTRUM ANALYSIS" mode. The setups, tolerance masks and background memory are not affected by this.

3.7.2.2 Default preset of the SNA

Meaning	Parameter	Setup
Operating mode	SELECTIVE LEVEL	CW
Center frequency	FCENT	1,569 995 500 GHz
Frequency span	FSPAN	3,139 991 000 GHz
Start frequency	FSTART	9 000 Hz
Stop frequency	FSTOP	3.14 GHz
Reference value	REFERENCE	0 dBm
Scale range	SCALE	100 dB
Resolution bandwidth	RBW	10 MHz, AUTO ON
Video bandwidth	VBW	10 MHz, AUTO ON
Sweep time	SWT	63.2 msec, AUTO ON

Fig. 3-6 Default setups of the SNA after pressing the "PRSET" key

Meaning	Parameter	Setup
Input attenuation	ATTN	AUTO ON
External attenuation	EXT ATTN	0 dB
External impedance	EXT IMP	50 Ω
Manual frequency tuning	MAN	1,569 995 500 GHz
Frequency counter	COUNTER	OFF
Frequency counter source	COUNTER SOURCE	CARRIER
Frequency counter resolution	COUNTER RESOLUTION	10 Hz
Frequency counter video threshold	COUNTER VIDEO THRS	- 100 dBm
External calibration frequency	CAL FREQ	21. 990 000 MHz
External calibration level	CAL LEVL	- 30 dBm
Measured value sampling	TRACE DETECT	MAX/MIN
Average weighting factor	AVERAGE WEIGHTING	64
Amplitude processing	TRACE PROCESS	ACTUAL
Display memory	TRACE MEM	A
REL marker unit	MARKER UNITS/REL UNIT	dB
Actual marker	ACTUAL MARKER	ABS
Marker display	MARKER ON/OFF	OFF
ABS marker frequency	MARKER ABS	1,569 995 500 GHz
ABS marker update	ABS-UPDATE	LIVE
ABS marker display value	MARKER ABS TRACE	MAX
REL marker frequency	MARKER REL	0
REL marker update	REL-UPDATE	LIVE
REL marker display value	MARKER REL TRACE	MAX
Marker level threshold	PEAK THRSHLD	- 100 dBm
Marker label display	MARKER LABEL DISPLAY	GRAPH
Marker label sorting	MARKER LABEL SORT	LVL
Actual marker label	SHOW/CLEAR	0
W&G logo for user title	LOGO	ON
Measurement title	TITLE	STD
Measurement title	STD TITLE	Blank
Display graticule	GRATICULE	ON
Representation of frequency axis	FSCALE	START/STOP
Scale of frequency axis	FREQ AXIS	LIN
Frequency step width for rotary control/step keys	FSTEP	AUTO ON
Amplitude step width for rotary control/step keys	LSTEP	AUTO ON
Representation of amplitude axis	SCALE	REL
Scale of amplitude axis	MEAS SCALE	LOG
Amplitude unit	LEVEL UNIT	dBm

Fig. 3-6 Default setups of the SNA after pressing the "PRSET" key

Meaning	Parameter	Setup
Tolerance mask display	TOLMASK	OFF
Tolerance mask evaluation	EVALUATE	OFF
Tolerance mask	EDIT MASK	No points set
Sweep	SWEEP	CONT
Spectral line in center of display	SIGNAL TRACK	OFF
Number of sweeps	REPEAT n TIMES	n = 1
Measurement mode	SWEEP/MAN/HOLD	SWEEP
Trigger mode	TRIGGER	FREE
Demodulator mode	DEMOD MODE	OFF
Demodulation type	DEMOD DEMOD	AM
Demodulator dwell time in MKR MODE	DWELL TIME	2 s
Loudspeaker volume of demodulated signal	VOLUME SPEAK	100%
Earphone volume of demodulated signal	VOLUME EARPH	50%
Display screen	DISPLAY SCREEN	INTERN
Display colors	INTERN	0
Display colors	EXTERN	0
Plotter interface	INTERFACE	COM 2???
Plotter language	LANGUAGE	HPGL
Number of plotter pens	PEN COUNT	2
Plotter type	TYPE	HP 7470 A
Printer interface	INTERFACE	LPT 1
Screen type	TYPE	ELX

Fig. 3-6 Default setups of the SNA after pressing the "PRSET" key

3.7.2.3 Default Preset of the TG

Meaning	Parameter	Setting
Generator offset	GEN OFFSET	0 Hz
Offset on/off	OFFSET ON/OFF	OFF
Generator level	GEN LEVEL	- 10 dBm
Generator on/off	GENERATOR ON/OFF	OFF
External ALC or "frozen"	ALC STATE	LIVE
Internal or external ALC	ALC MODE	INT
External attenuators	EXTERN ATTN	0 dB
Impedance of the external attenuator	EXTERN Z	50 Ω
External sensor for ALC	SNSE	EPM
Full scale for power meter	PWM RANGE	0 dBm

Fig. 3-7 Default setups of the TG after pressing the "PRSET" key

Meaning	Parameter	Setting
CAL TABLE for an external detector	Detector #	1
Output attenuation	STEP ATTN	AUTO ON
Save CAL TABLE	SAVE TABLE	1
Recall CAL TABLE	RECALL TABLE	1
Screen type	TYPE	ELX

Fig. 3-7 Default setups of the TG after pressing the "PRSET" key

3.8 Configuring the instrument

The instrument is already configured on delivery. The German keyboard driver is installed, to allow an external keyboard to be connected if desired. You can load the US keyboard driver by pressing CTRL+ALT+F1 simultaneously. If you need to reload the German keyboard driver, press CTRL+ALT+F2.

3.9 Diskettes

Format

The scope of supply of the SNA includes a 3 1/2" diskette with a storage capacity of 1.44 MB; it contains the compensation data of your instrument.

Handling rules

Although 3 1/2" diskettes are designed with a plastic casing and a metal shield to protect them against rough handling, there are nevertheless a few rules which should be observed in the interests of avoiding data loss:

- Keep all diskettes in a safe place!
- Keep diskettes away from magnetic fields!
- Never touch the magnetic disk inside the casing!
- Do not attempt to clean diskettes!
- Protect diskettes against dust, moisture and heat!

Inserting the diskette in the drive

Insert the diskette in the drive of the SNA with the label facing towards the right to the instrument. The diskette will click when it is properly inserted. It will not click if it is inserted the wrong way round.

Please make sure that the write protection tab on the reverse side of the diskette is always set to the "WRITE ENABLE" position, or you will not be able to save any instrument setups.

Removing the diskette from the drive

Press the button on the drive in order to release the diskette.

Attention: Never attempt to remove the diskette from the drive while it is being accessed by the CPU (i.e. while the LED on the drive is still lit)!

3.10 Switching off the instrument

You can reset the instrument to standby mode by pressing the ON/OFF switch again. This causes the green LED to light up.

You must wait approximately 5 s after pressing the ON/OFF switch before resetting the instrument to measurement mode.

If you intend to leave the instrument switched off for a long time or move it to a different location, you can switch it off completely by pressing the power switch on the rear.

3.10.1 Data backup

The current instrument setups, compensation data, etc. are saved in a non-volatile semiconductor memory, which is supplied by a lithium battery whenever the instrument is switched off.

If the most recent setups are not restored when the instrument is switched on again and the initial setting (operating mode menu) is displayed instead, the lithium battery may have reached the end of its service life. Data may be lost as a result.

Check whether all the parameters are preset to fixed values. In this case, the instrument setups which are stored in the B: drive (RAM) - including the tolerance mask and the measurement curve(s) - will likewise have been deleted and the external calibration values lost. If so, the battery must be replaced.

The lithium batteries are installed on the CPU board (for the AT computer setups) and the EPROM board (for backing up data). A plug-in battery type is used, making them easier to replace.

Protect your environment

If you no longer need the lithium batteries, please do not dispose of them as ordinary refuse. This applies both when you replace the batteries and when you remove them prior to scrapping the instrument. Hand the batteries in at a special collection point for problem waste or for recyclable raw materials, if there is one near you. You will normally be able to hand in your old lithium batteries at the place where you buy the new ones. If you purchased them from W&G, you can return them to one of our Service Centers.

3.10.2 Compensation data disk and compensation data

Your analyzer is delivered with a diskette labelled "Compensation Data". This diskette contains the frequency response and logarithmic function specifications which were measured for your analyzer. Before the instrument was shipped, these compensation data were stored in the battery-backed RAM (drive B:) of the SNA. As a safety precaution, a copy of the data for your instrument is included. There is only one copy of this diskette, and you have it! Make a backup copy and keep the two diskettes in a safe place.

3.10.3 Loading the compensation data

If the compensation data in your SNA are ever lost (e.g. due to a discharged battery; normal battery life = approx. 10 years), you must reload the compensation data.

Attention: Any existing USER MEM setups are erased in this process. If you wish to keep your setups, copy them to a diskette in the DOS-UTILITIES menu with the function: Backup RAM SETUP TO FLOPPY (see Abschnitt 4.1.15 auf Seite 8).

Loading the compensation data

– Turn off the SNA with the ON/OFF key (standby).
– Insert the diskette with the "Compensation Data" into the disk drive of the SNA.

Attention: The serial number on the diskette must agree with that of your SNA!

– Turn on the SNA with the ON/OFF key --> the diskette will be read. The following message should appear on the screen:
Caution! The SRAM disk (drive B:) will be reformatted.
– Answer "Yes" and the compensation data will be loaded into the SRAM disk (drive B:).
– Press the button on the drive to remove the diskette.
– Turn off the SNA with the ON/OFF key (standby).
– Turn on the SNA with the ON/OFF key --> the compensation data have been restored.

3.10.4 Operation after storage and transport

Safety

The instrument may be subjected to considerable stress as a result of storage and transport. Please read the safety instructions contained in chapter 2.

Recovery time

An instrument which has been stored or transported at a low temperature may condensate if it is moved into a warm room. To avoid damaging it, wait until no more condensation is visible on the surface before switching it on. The instrument will not be operational until it returns to the guaranteed operating temperature range (-5 to +55 °C).

This applies likewise if the instrument has been stored at a high temperature.

Built-in lithium batteries

The instrument contains a lithium battery for supplying the semiconductor memories that are used to store the setups and back up the data in the event of a power failure. The battery may need to be replaced if it is not used for a long period. In this case, the initial setting, i.e. the operating mode menu, will appear on the display when the instrument is switched on again (see also Data backup).

3.11 Mounting in 19" racks

The dimensions of the frame conform to DIN 41 494 and IEC 297, as well ASA 83.9 (US). The instrument is thus suitable for mounting in 19" racks. The necessary conversion kit can be ordered under number BN 700/00.17.

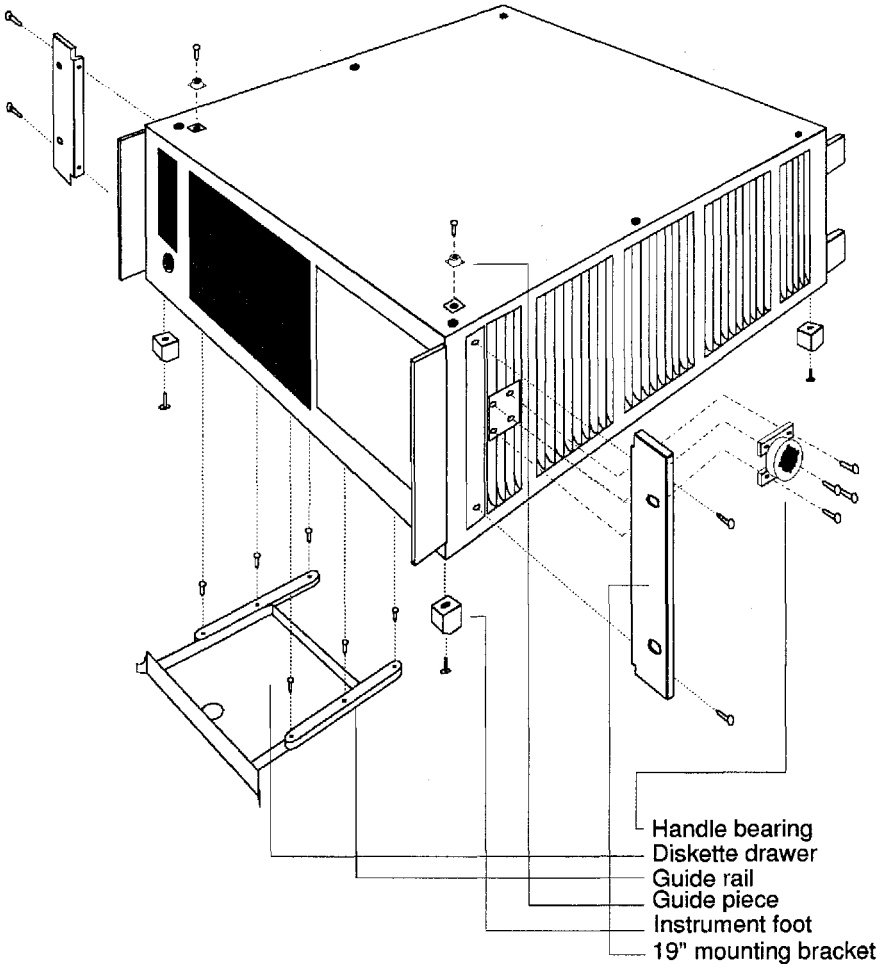


Fig. 3-8 Converting the SNA for mounting in 19" racks

Attention: Always disconnect the SNA from the a.c. power supply and from all other power sources before attempting to convert it, as live parts are exposed when the base of the frame is removed!

Mounting procedure:

- Detach the carrying handle by pressing the buttons on the handle bearings and simultaneously moving the handle back 45° beyond the top detent position, then pulling the side sections apart (see also Fig. 3-1).
- Unscrew the handle bearings on both sides (four Phillips screws each). If you need to transport the instrument with the carrying handle again, you must fit the handle bearings back in the positions shown in Fig. 3-1.
- Unscrew the plastic guide pieces on the top side of the instrument (2 hexagon screws).
- Remove the rubber corners (undo the 4 M4x20 hexagon screws first).
- Turn the instrument round.
- Unscrew the instrument feet.
- Remove the rubber corners (undo the 4 M4x20 hexagon screws first), then secure the base of the frame with M4x12 hexagon screws (contained in the modification kit).

- Remove the base of the frame (2 hexagon screws) and turn it round. The six Phillips screws which secure the guide rails of the diskette drawer are now accessible.
- Unscrew the guide rails and remove them together with the diskette drawer.
- Fit the base of the frame back on again (secure it with 6 M4x12 hexagon screws).
- Screw on the 19" mounting bracket (see Fig. 3-2).
- Fit the instrument in the 19" rack and screw the mounting bracket tight.

Instrument cabinet

If the instrument is used inside a cabinet, the maximum permissible ambient temperature (+50 °C) must not be exceeded. Provision must therefore be made for adequate ventilation. If necessary, leave one height unit (44.4 mm) both above and below the instrument and seal the gaps with dummy panels.

4 Getting started

4.1 Operating concept

4.1.1 Display

The focal point of any measuring instrument is its display. The SNA has an integrated EL display with an EGA resolution of 640 x 350 pixels. The operating mode, the results of the measurements, the main instrument parameters and any status and error messages are all visible at a glance.

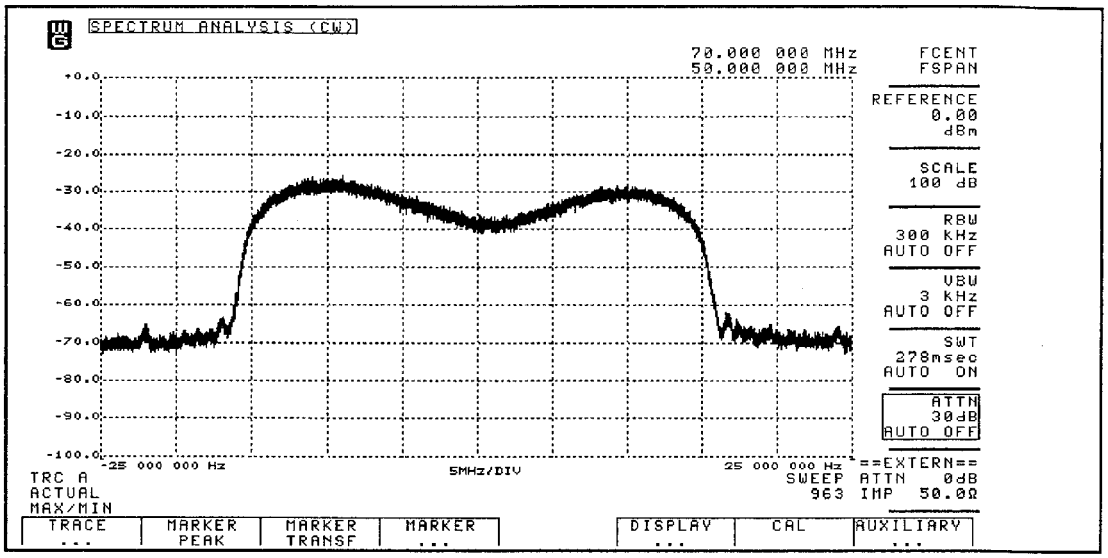


Fig. 4-1 Standard display (operating mode, result, graticule, parameter menus, parameters, cycle counter, acquisition, processing and representation of measured values)

4.1.2 Menu control

The SNA is a menu-controlled instrument. You can call up the operating modes and the instrument setups using the SET keys.

The instrument's functions are organized in softkey menus. The menus can be called up using the softkeys in the bottom display margin. The parameters can be selected with the softkeys in the right-hand margin.

MODE menu, setting the operating mode

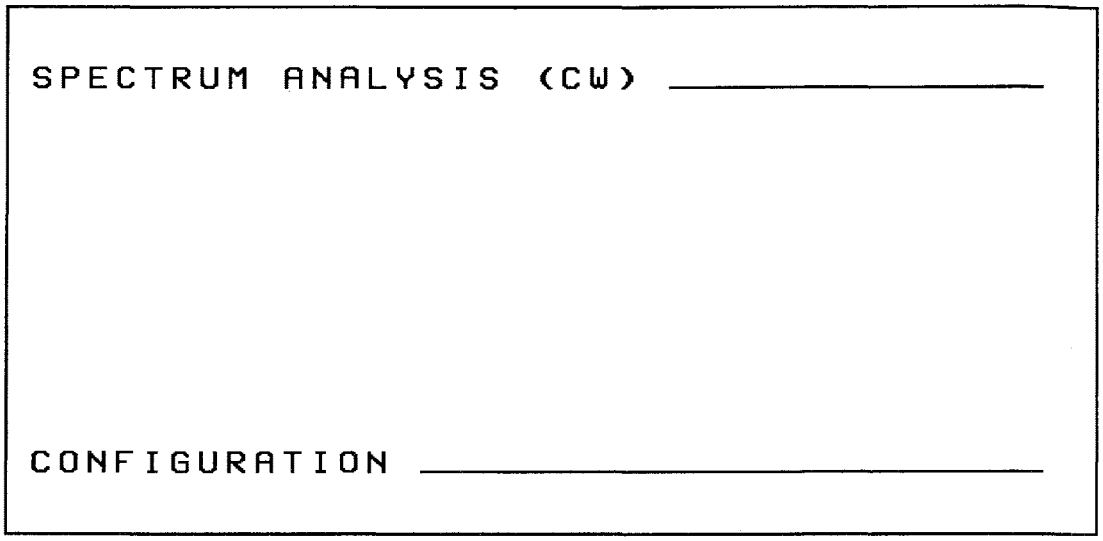


Fig. 4-2 MODE: Menu of the operating modes

This menu can be used to select the available instrument modes. These are currently "spectrum analysis" and "configuration" (a support mode). The menu can always be called up directly by pressing the "MODE" key, irrespective of the instrument status. It can be exited by selecting a mode with one of the softkeys in the right-hand display margin.

Main menu

The main menu lists the most important measurement parameters in the right-hand display margin; they can be selected directly using the corresponding softkeys. At the bottom of the display are softkeys for opening more parameter menus. This principle - parameters on the right, submenus at the bottom - has been observed throughout the menu structure of the instrument.
You can return to the main menu from any submenu by pressing the "RTN" key.

Submenus

The softkeys at the bottom of the display can be used to call up the parameter menus and submenus for which there is no room in the main menu.

If there is more than one submenu behind a softkey, this is indicated by three periods. They appear in the softkey bar at the bottom of the display when the key is pressed. The currently active submenu is highlighted in inverse representation; the parameters can be selected and changed using the softkey bar in the right-hand margin. When you return to the main menu, the system remembers the last open submenu; it is displayed again immediately as soon as you reopen it.

Changing parameters and functions with softkeys

There are 8 softkeys in the right-hand display margin ([SF1]... [SF8]). Their functions are defined by the program and specified in the same line of the display.

4.1.3 "SET", selecting the operating mode or instrument setup

SET 3

PRSET **PRSET** The standard setup of the SNA is displayed and all the parameters and functions are set to their default values.

MODE **MODE** The operating mode menu is displayed on the screen.

USER MEM **USER MEM** The menu for saving the instrument setups and the measurement curves can be opened by pressing the "USER MEM" key.

RCL **RCL** This key permits a setup to be recalled directly, without having to go through the USER MEM menu.

4.1.4 DIRECT SETTING, direct access keys and transfer functions

DIRECT SETTING 4

FCENT FSPAN REF MKR PEAK

FCENT, FSPAN, REF

These keys open an input box above the display, irrespective of the menu which is currently visible. The parameters are set in the same way as the menu parameters

MKR

This key activates the ABS marker and the REL marker alternately. The currently active marker is indicated by means of an arrow in front of the marker result lines and the input box which is open in the top right-hand corner of the display. The active marker can be moved with a numeric input, the rotary control or the marker functions.

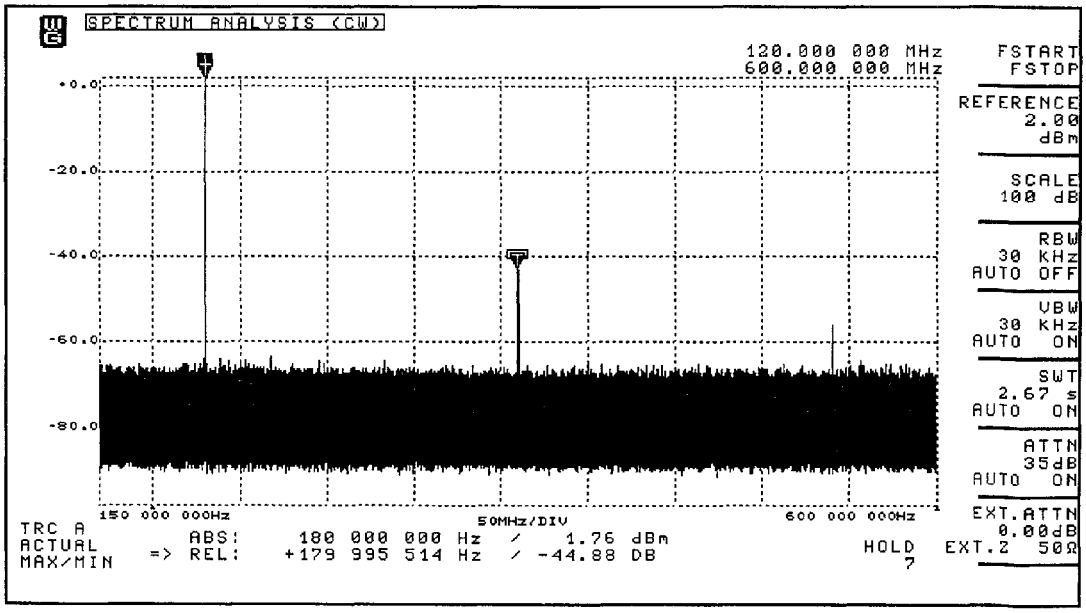


Fig. 4-3 Marker with PEAK functions

PEAK

The PEAK function provides a quick way to set the markers to the HIGHEST PEAK or NEXT PEAK. The effect of this key depends on which marker is open or active:

Markers	Effect of the PEAK key
Both markers off or located off the screen	Switches on the ABS marker and sets it to the highest visible amplitude value.
ABS marker already on (marker values displayed below the screen graticule)	Sets the ABS marker to the highest visible amplitude value.
ABS marker already on the HIGHEST PEAK; REL marker off	Switches on the REL marker and sets it to the highest visible amplitude value. The REL marker is not yet visible on the screen since it has not yet been activated. If the REL marker is now activated with the MKR key, it appears on the HIGHEST PEAK, like the ABS marker. The active marker is indicated by an arrow in front of the marker values.
ABS marker already on the HIGHEST PEAK; REL marker already on	The REL marker appears on the HIGHEST PEAK, like the ABS marker.
ABS and REL markers on the HIGHEST PEAK; REL marker active	Sets the REL marker on the NEXT PEAK
ABS marker on the HIGHEST PEAK, REL marker on the NEXT PEAK	Sets the REL marker on the NEXT PEAK

Fig. 4-4 PEAK key functions

Note: Even if the ABS marker is set to HOLD mode in the MARKER UPDATE menu, it is set to the highest visible amplitude value when you press the PEAK key.

Transfer functions

The marker key provides access to powerful transfer functions in conjunction with the FCENT, FSPAN and REF keys.

TRANSFER ABS marker frequency --> center frequency

If you press the FCENT key first and hold it down while **simultaneously** pressing the MKR key, the current marker frequency is accepted and set as the new center frequency. The peak to which the ABS marker is set is thereby moved to the center of the display. The frequency value of the ABS marker is always copied, irrespective of the currently active marker.

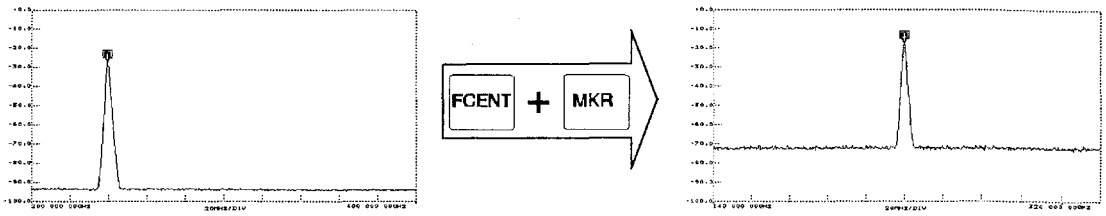


Fig. 4-5 TRANSFER ABS marker frequency --> center frequency

TRANSFER ABS marker amplitude value --> reference value

If you press the REF key first and hold it down while simultaneously pressing the MKR key, the marker amplitude value is accepted and set as the new reference value. The peak to which the ABS marker is set is then moved to the top line of the display (reference line). The amplitude value of the ABS marker is always copied, irrespective of the currently active marker.

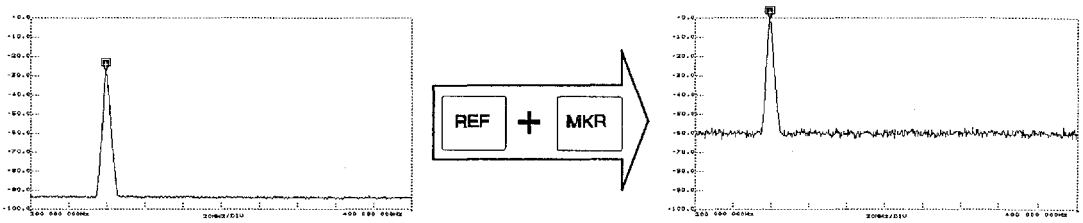


Fig. 4-6 TRANSFER ABS marker amplitude value --> reference value

TRANSFER marker interval --> sweep span

First of all, mark the desired subfrequency range with the ABS and REL markers. If you then press the FSPAN key and the MKR key simultaneously, the range between the ABS MKR and the REL MKR is accepted and set as the new sweep span. The lower marker frequency value is defined as the start frequency and the higher value as the stop frequency. A subfrequency range can thus be "cut" out of the full range using the two markers.

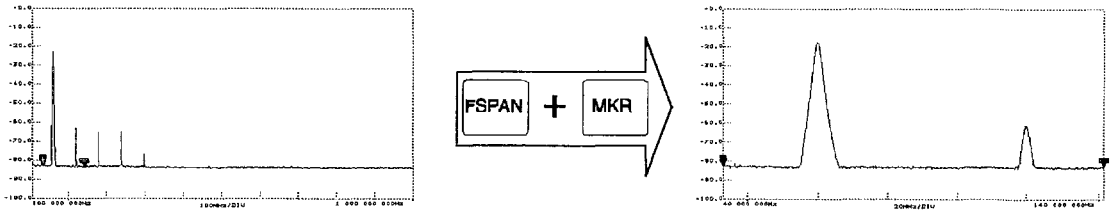
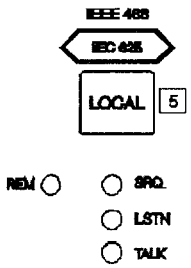


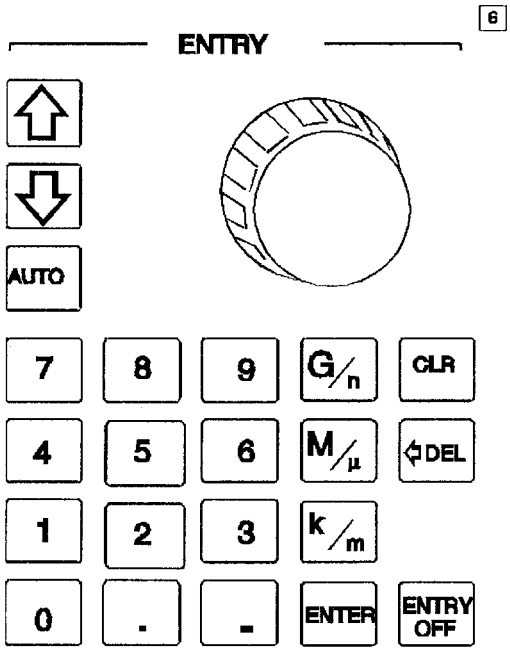
Fig. 4-7 TRANSFER marker interval --> sweep span

4.1.5 IEEE 488



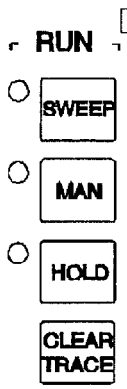
LOCAL switches the instrument over from remote control to manual mode.

4.1.6 ENTRY



The ENTRY functions can be used to enter, modify and delete selected numeric parameters and to confirm the inputs.

4.1.7 RUN keys



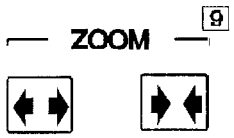
SWEEP restarts the sweep after the instrument has been on HOLD (note the conditions for the trigger and sweep modes).

MAN permits the instrument to be tuned manually using the rotary control, within the frequency range selected with START/STOP or FCENT and FSPAN. A cursor indicates the current amplitude value which is measured for the set frequency. The currently set frequency is shown just below the graphical result field.

HOLD interrupts the sweep. The measurement curve is not altered any more. The HOLD function is canceled again by MAN and SWEEP. CLEAR TRACE is not active when HOLD is pressed.

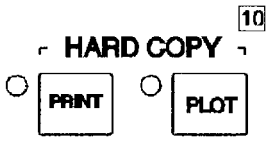
CLEAR TRACE clears the measurement curve and starts the sweep at the start frequency (note the trigger conditions).

4.1.8 ZOOM



The zoom function enables the frequency range to be stretched around the ABS marker or "unstretched" again. The zoom factor is 10, and the ZOOM function can be used five times in a row.

4.1.9 HARDCOPY



The hardcopy function starts a printout of the display contents. The PRINT and PLOT keys have the same function.

4.1.10 Setting parameters

All the parameters which can be set in a particular menu are shown either on the right-hand side of the display or in a box above the graticule. A name and value are displayed for each parameter.

There are various types of parameter, set in different ways:

- **Toggles:** The function of this type of softkey alternates each time it is pressed, e.g. MARKER ON/OFF.
- **Direct selections**, e.g. TRACE PROCESS: The name of the parameter is enclosed between the first value and the second value, and the name/value affiliation is underlined by means of a parenthesis. Each function has a direct softkey assignment. The function is activated immediately this softkey is pressed.
- **Numeric parameters set either continuously or in steps** with the rotary control, the STEP keys or the numeric keypad. They include all frequency and level settings, as well as addresses and times.

Input

Many different values are allowed for numeric parameters, e.g. frequencies and levels. Any invalid values are rejected (or in a few cases limited).

– - Press the softkey to open the input. The frame which appears on the display indicates the "input open" status.
– - You can now alter the value in steps using either the rotary control or the STEP keys. The step width depends on the parameter and is sometimes preset by another parameter (LSTEP, FSTEP).
– - Numeric inputs must be terminated by pressing one of the dark gray "ENTER" keys on the numeric keypad.

4.1.11 Results

Measurements are normally taken automatically within the set frequency range. The results are represented in the form of a measurement curve or curves. They can be evaluated with the aid of a tolerance mask and markers or marker labels.

4.1.12 Cycle counter

The cycle counter is displayed on the right underneath the graticule. It shows the number of valid measurements. The counter is reset automatically when the instrument is switched on and whenever any of the most important instrument parameters are altered. This serves as an indication that the currently displayed measurement curve is no longer valid. The cycle counter is incremented by one when the curve reaches the right-hand display margin (at the end of a full sweep).

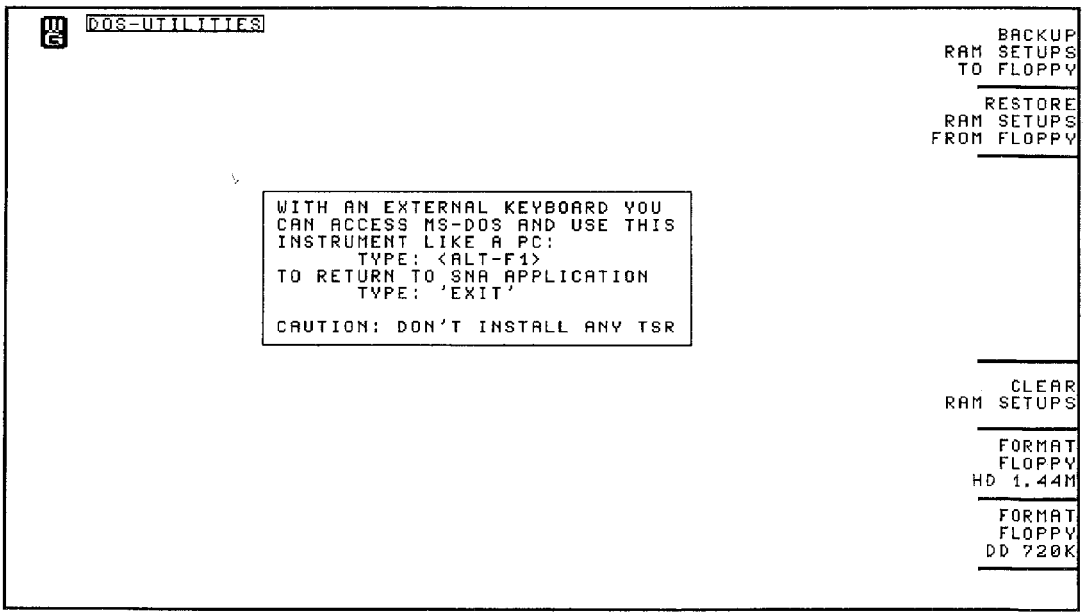
4.1.13 Advisories and error messages

Advisories and error messages are displayed underneath the mode name as and when necessary. They disappear again automatically after a short time.

4.1.14 Demodulator output

If the demodulator is active, it is possible to listen to the demodulated signal, either through the built-in loudspeaker or using an earphone connected to the socket on the backplane.

4.1.15 DOS-Utilities



In this menu, you can use the SNA like a PC. Certain functions can be called up directly with the function keys.

4.1.16 Assignment of the instrument keyboard under DOS

When operated under DOS, the instrument keyboard has a different assignment. You can thus execute the most important functions even without an external keyboard (e.g. the Setup program).

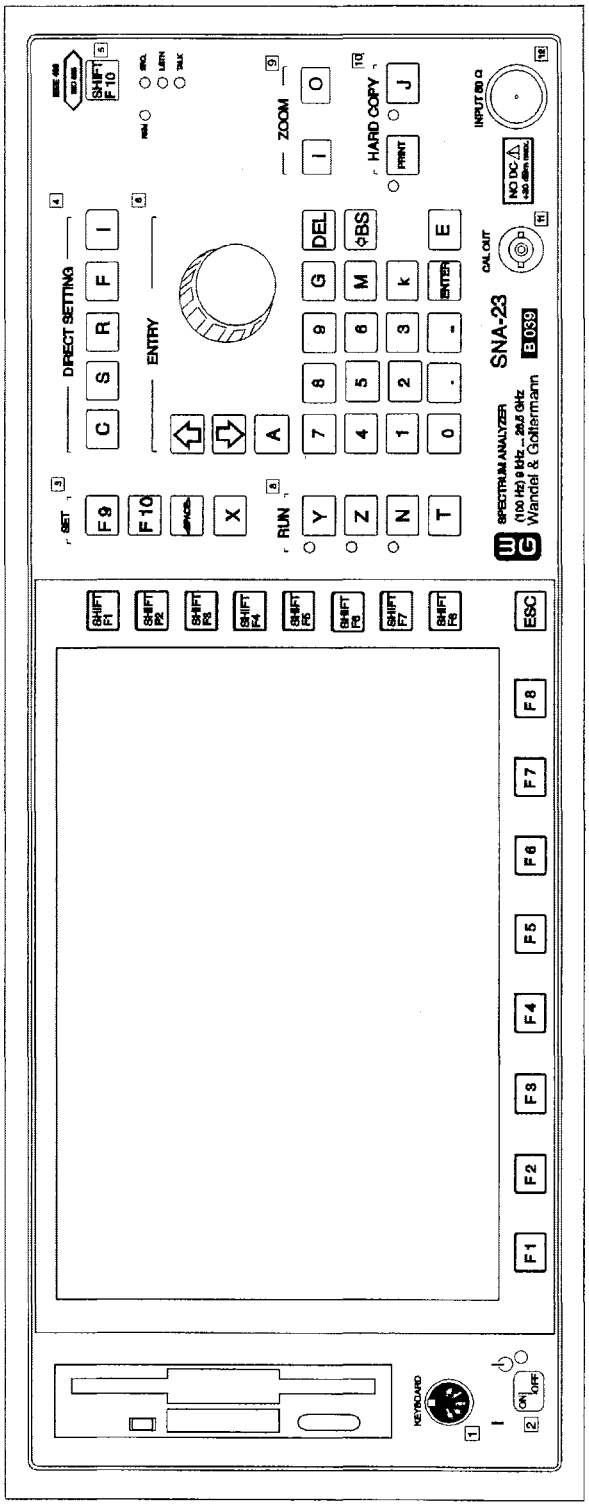


Fig. 4-8 Assignment of the instrument keyboard under DOS

4.2 Marker Label menu

In the Marker Label menu, 20 labels can be assigned. Like markers, these labels indicate the frequency and amplitude of their associated signals.
You can set labels in two ways:
- Manually using "LABEL MKR POS" at the position of the active marker, or
- Automatically using "LABEL ALL PEAKS" to cover all peaks above the adjustable "PK.THRSHLD".

You can switch display of the labels between:
- Marking of the signals in the measurement trace, and
- Listing of the assigned labels. They can also be printed or plotted in this format.

Example

If you'd like to try out the label functions for yourself, work through this example on the SNA. The figures in this section were generated using the same steps.

- Connect the reference frequency output (10 MHz) on the back of the instrument to the input of the SNA.
- Press the **MODE** key to call up the mode menu.
- Press **[F1]** to select the SPECTRUM ANALYSIS (CW) mode.
- Set the parameters as follows:

FSTART 5 MHz	FSTOP 205 MHz
REFERENCE 10 dB	SCALE 100 dB
RBW 100 kHz	VBW AUTO
SWT AUTO	ATTN AUTO
EXT ATTN 0 dB	EXT Z 50 Ω

- Press the **SWEEP** key and wait for at least one sweep pass to run.
- Press the **HOLD** key to freeze the measuring screen (if something changes on the screen during the labelling operation, the labels might be incorrectly assigned).
- Press **[F6]** to call up the DISPLAY... submenu.
- Press **[F3]** to call up the MARKER LABEL submenu.

4.2.1 Labelling all peaks

- Press **[SF8] PK.THRSHLD** to open input of the amplitude threshold.
- Set the **amplitude threshold** (e.g. with the rotary control). It should lie between the noise floor and the amplitude peaks (about -48 dBm in the example)).
  The first 20 peaks above the "PK.THRSHLD" are assigned a label. If the amplitude threshold is in the noise or below the noise, noise peaks can also be labelled.
- Press **[SF6]** to select **sorting** of the labels using the **SORT by FREQ/LVL** parameter. Sorting applies only upon assignment; the labels cannot be resorted.
- Press **[SF4] LABEL ALL PEAKS** if all labels are to be assigned. 20 peaks lying above the level threshold can be labelled.

Warning: Any previously assigned labels are overwritten.
Traces having spikes are given multiple peak labels!

- Press **[SF7] DISPLAY GRAPH/LIST** to select display of the labels. They can be displayed in tabular format, or the marked measurement trace can be viewed graphically.

DISPLAY GRAPH

If you have chosen the setting [SF7] DISPLAY GRAPH, all labels are displayed as boxed-in numbers alongside of the corresponding screen points in the measurement trace. The peaks are marked according to the selected sorting scheme (e.g. by decreasing amplitude).

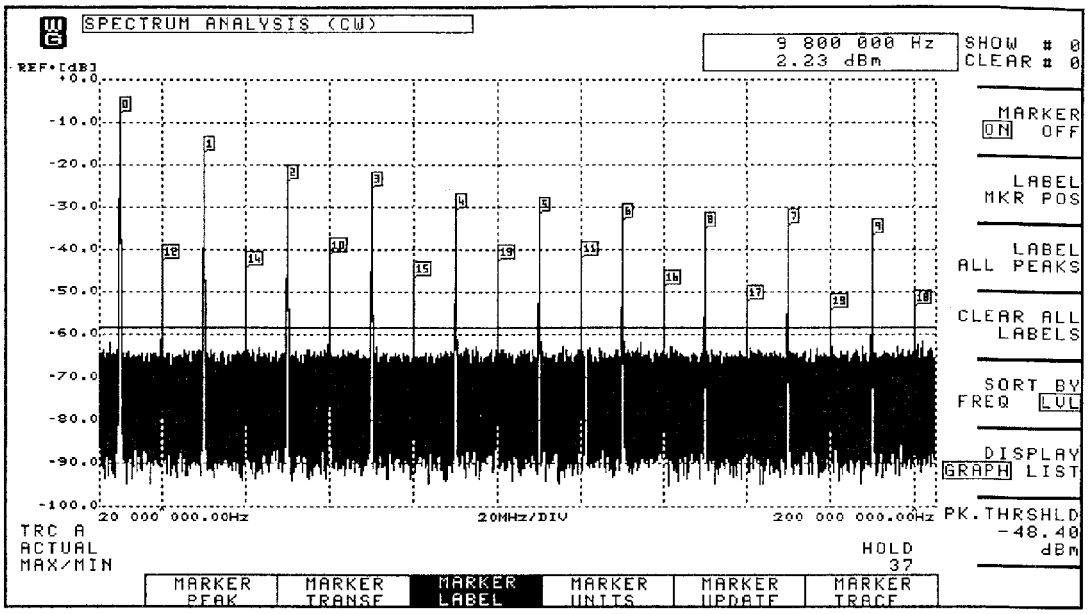


Fig. 4-9 Labels in trace format (sorted in order of decreasing amplitude)

DISPLAY LIST

You can subsequently change the display format (trace or table), but the labels remain in the order as generated.

If [SF7] DISPLAY LIST is set, the labels are listed in tabular format with the selected sorting method (e.g. by decreasing amplitude).

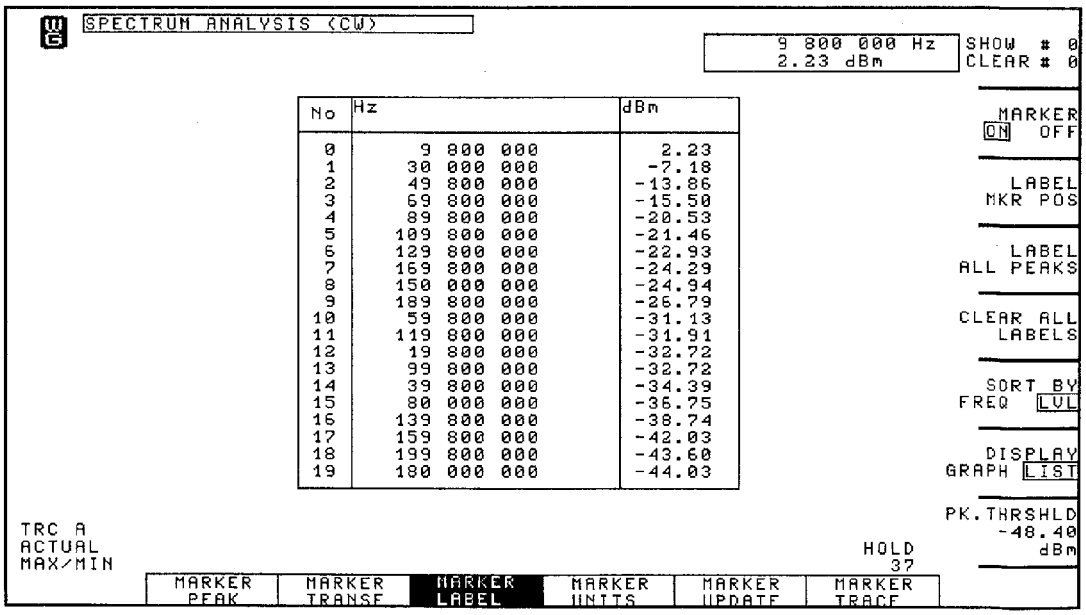


Fig. 4-10 Labels in list format (sorted in order of decreasing amplitude)

Note: If you need to resort the labels after an automatic "LABEL ALL PEAKS" operation, make sure the instrument is in a HOLD state and:
- Press **[SF5] CLEAR ALL LABELS**
- Press [SF6] to redefine the sorting
- Press **[SF4] LABEL ALL PEAKS** to reassign the labels.

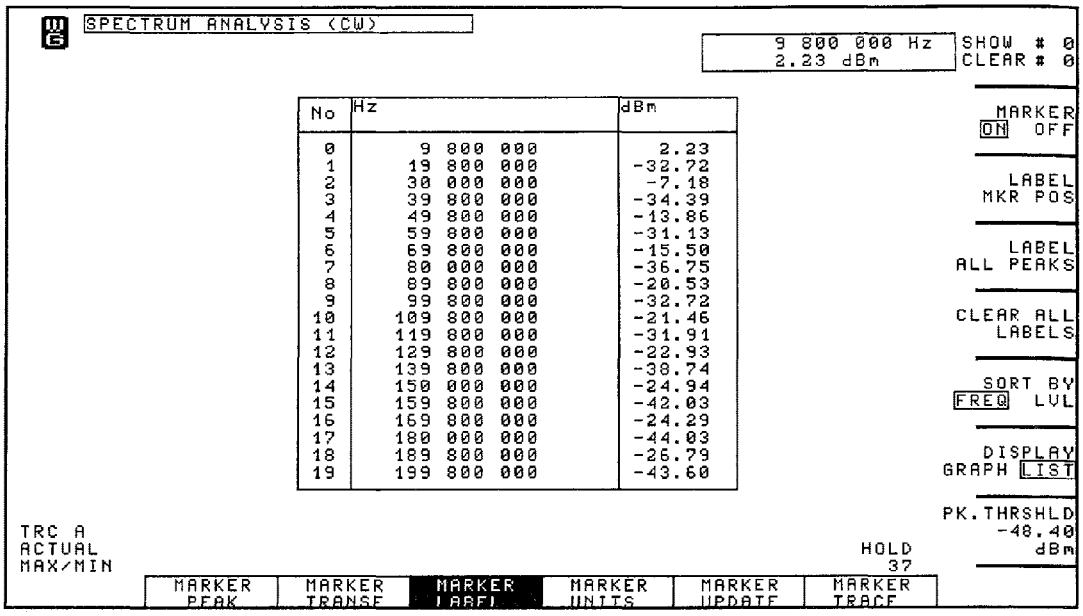


Fig. 4-11 Labels in list format (sorted in order of increasing frequency)

4.2.2 Displaying the measured values for a label

- Press **[SF1]** to select **SHOW # n**.
- Use the rotary control, step keys or keypad --> ENTER to select the label for which you wish to display the coordinates.

4.2.3 Clearing all the labels

- Press **[SF5] CLEAR ALL LABELS** to clear the currently set labels.

4.2.4 Assigning individual labels

- Press the **MKR** key to open the marker display. A window should open above the screen graticule showing the current position of the active marker. This marker can lie outside of the visible range.
- Use the rotary control, step keys or keypad --> ENTER to set the marker at the point you wish to label.
- Press **[SF3] LABEL MKR POS** to label the marker position.

4.2.5 Deleting individual labels

- Press **[SF1]** to select **CLEAR # n**.
- Use the rotary control, step keys or keypad --> ENTER to select the label to be deleted.

4.3 Measurements with the SNA-23/SNA-20 and the TG-23/TG-20 Tracking Generator

The TG-20 and TG-23 Tracking Generators for the SNA-20 and SNA-23 Spectrum Analyzers are pure CW sources i.e. no modulation is possible with their continuous output signal. In conjunction with the SNA-20/SNA-23, the generators make possible a variety of measurements which would otherwise require a network analyzer.

This includes measurements of:
- Transmission (e.g. frequency response of DUTs)
- Reflection
- Gain or loss.

Typical DUTs are two-port networks having an input and output, such as amplifiers, attenuators, filters and combiners. The procedure for measuring transmission and reflection is described in the following section.

4.3.1 Transmission measurement

Measurement of the amplitude frequency response of a bandpass filter.

Connect the device under test (DUT)

- Connect the DUT to the generator output and the receiver input.

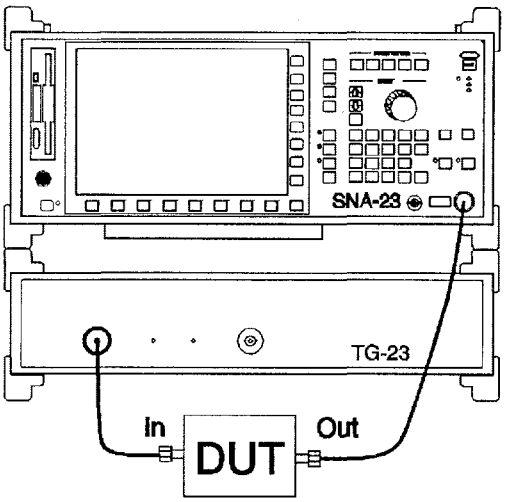


Fig. 4-12 Test setup for measuring the transmission of a bandpass filter

Warning: Use cables that are as short as possible and make certain that they are appropriate for the selected frequency range. Use N connectors only up to a maximum frequency of approximately 22 GHz.

Set the frequency range

The frequency range can be set in two different ways:
- With [SF1] twice in a row (start and stop frequency), or
- With the FCENT key for the center frequency and the FSPAN key for the frequency span.

In this example, we are testing a bandpass filter with a known center frequency.

Note: The generator has not yet been turned on (via softkey).

- Press the **FCENT** key to open input of the center frequency. A window should open above the screen graticule showing the current center frequency.

- Input the new center frequency using the rotary control, step keys or keypad[1].
- Press the **FSPAN** key to open entry of the frequency span. The current frequency span is shown in the window above the screen graticule.
- Enter the new frequency span using the rotary control, step keys or keypad[1].

Select the generator level

- Press **[F5] Generator...** in the main menu to open the Generator main menu.
- Press **[SF3] GEN LEVEL** to open entry of the generator level.
- Enter the required generator level using the rotary control, step keys or keypad-->ENTER.

Power up the generator

- Press **[SF4] GENERATOR ON** to turn on the output of the generator. The transmission of the DUT should now appear on the screen of the SNA, displayed vs. the selected frequency range.
- Press **RTN** to return to the main menu.

Optimize the parameters

Automatic coupling of the parameters in the basic setting

The automatic circuitry provided in the SNA is set up for spectrum analysis of unknown signals. In network analysis, the receiver runs in synchronization with the generator, such that the receiver always "sees" the generator signal. Thus, the settling time of the resolution bandwidth filters does not have the same importance in network analysis as in spectrum analysis. The parameters RBW (1 MHz), VBW (1 MHz), SWT (25 ms) and ATTN (30 dB) are automatically selecting by the SNA in the basic setting, but they should be adapted to the DUT.

RBW (Resolution BandWidth)

Select a resolution bandwidth RBW which equals about 0.1% of the passband of your DUT. Example: The filter to be measured has a 3 dB bandwidth of 40 MHz. We should therefore set an RBW of 30 kHz - 100 kHz. If the passband is unknown, an alternative rule of thumb is RBW = 0.1% of FSPAN.
Example: FSPAN = 10 MHz, RBW = 10 kHz.

If necessary, the noise floor can be further lowered by reducing the RBW. The instrument will select a value for SWT via its automatic circuitry. In network analysis applications, this value can normally be reduced significantly.

VBW (Video BandWidth)

Based on the automatic setting made by the SNA (which sets a value equal to RBW), select a video bandwidth VBW which is 1 or 2 steps below the RBW.

SWT (SWeepTime)

In this mode, the sweep time is no longer subject to the constraints of spectrum analysis. The sweep rate is highly dependent on the settling behavior of the DUT. When measuring on a broadband amplifier, you can sweep very quickly, but on a narrowband filter, you have to slow down to allow the DUT to settle in. The SNA's automatic circuitry sets the SWT to larger values for smaller bandwidths.
Check the SWT: Reduce the SWT until you notice a change in the shape of the curve. If the curve looks skewed and drifts to the right, the SWT is too small and the test setup no longer has sufficient time to settle in. Now, increase the value until the result on the screen no longer changes.

---

1 Terminate entries via the keypad with G for GHz or M for MHz or k for kHz or ENTER for Hz

ATTN (ATTeNuator)

The input attenuator ATTN can be set to smaller values for the measurements discussed here than are conventional in spectrum analysis since distortion products (harmonics) from the receiver are not recorded due to the tracking mode.

Select a value for the input attenuation such that [GEN LEVEL+ATTN = mixer level] produces a value of about -20 dBm. Example: For a generator level of -10 dBm, a value of [-10 + (-10) = -20] i.e. 10 dB should be selected for ATTN. This example assumes that the attenuation minimum of the DUT is small i.e. it ranges from 0 to 2 dB. An attenuation value which is too large degrades the signal-to-noise ratio, which can hamper the determination of large attenuation values. An attenuation value which is too small can, depending on the DUT, cause amplitude errors due to compression i.e. due to mixer overdrive.

REFERENCE

Set the reference such that about 3-4 dB of reserve is left to the upper graticule line.

Note: The UNCAL message does not matter in network analysis applications.

4.3.1.1 Displaying the measurement trace

Adjust the start frequency or center frequency if necessary.

- Press the **MKR** key to open marker display. A window should open above the screen graticule showing the current position of the active marker. The marker can lie outside of the visible range.
- Press the **PEAK** key to set the marker to the HIGHEST PEAK.
- Press the **MKR** key as well as the **FCENT** key. The SNA now accepts the marker frequency as the new center frequency.

In MAX/MIN display mode, the maximum value is linked to the minimum value of each measurement interval; a noise curve is visible. If the noise curve disrupts the display, you can switch to MAX or SAMPLE display mode.

- Press **[F1] TRACE...** to open the submenu.
- Press **[F1] TRACE DETECT** to open the submenu.
- Use **[SF2]** or **[SF5]** to select **DETECT MAX** or **DETECT SAMPLE**, respectively.
- Press **RTN** to return to the main menu.

Note: In SAMPLE display mode, the markers must be switched over to MIN. For ABS and REL markers, select the MIN function instead of MAX.

- Press **[F5] MARKER...** to open the submenu.
- Press **[F7] MARKER TRACE** to open the submenu.
- Press **[SF3] ABS TRACE** until MIN is selected.
- Press **[SF4] REL TRACE** until MIN is selected.
- Press **RTN** key to return to the main menu.

Both markers are now running on the sample trace.

4.3.1.2 Recording the intrinsic frequency response through a reference measurement

- Disconnect the DUT and hook up a coupler in its place. Both measurement cables are thus included in the reference measurement.

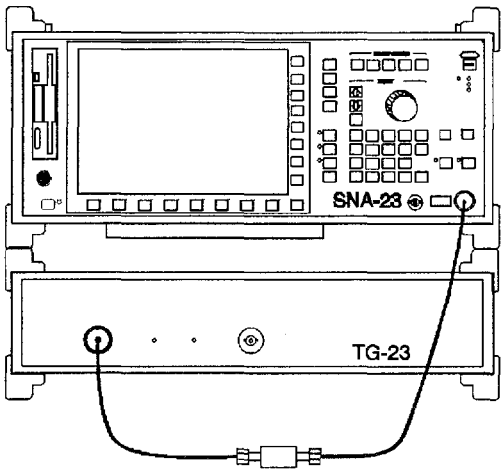


Fig. 4-13 In the reference measurement, a coupler replaces the DUT.

- Press the **CLEAR TRACE** key to clear the current trace. Wait for a complete sweep pass to run.
- Press **[F1] TRACE...** to open the submenu.
- Press **[F3] TRACE MEMORY** to open the submenu.
- Press **[SF7] STORE A-->B** to store the current reference values in background memory.
- Press **[SF4] A-B** so that the difference between screen memory A and the reference measurement in B is measured and displayed.
- Press **[SF5] A-B ZERO POS** until the zero line becomes the uppermost graticule line (TOP).
- Press the **RTN** key to return to the main menu.

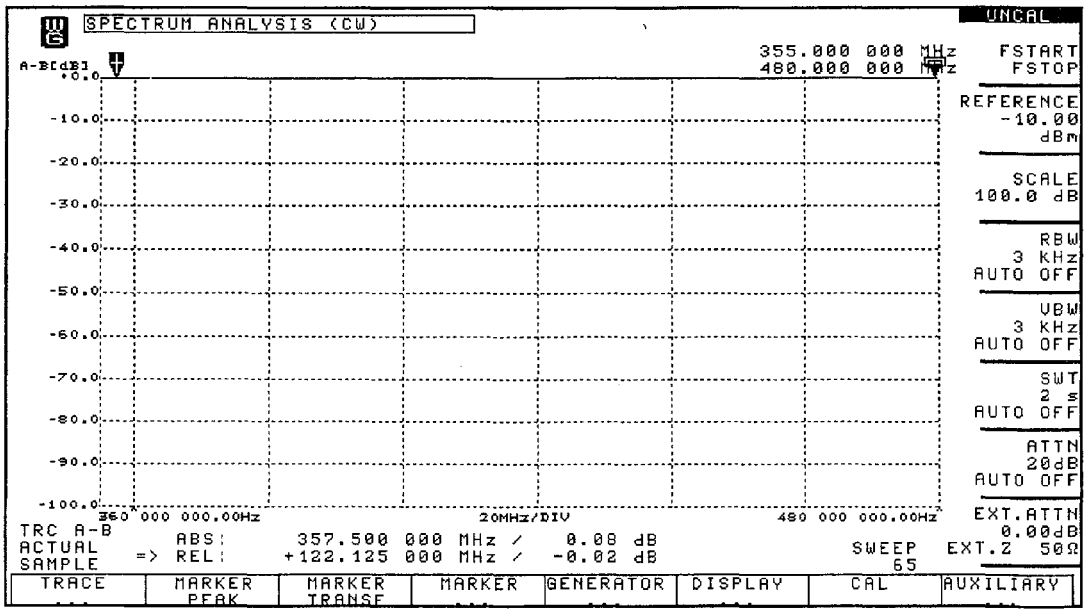


Fig. 4-14 Once the reference measurement is stored in background memory B and A-B display mode is selected, the test setup is normalized.

- Reinsert the DUT (see Fig. 4-11 on page 4-12). The frequency response of the DUT should now be displayed.

4.3.1.3 Creating a tolerance mask

- In the main menu, press **[F6]**, **DISPLAY...** to open the submenu.
- Press **[F6] TOLMASK EDIT** to open the submenu.

Deleting the existing tolerance mask (if present)

- Press **[SF6] DELETE ALL POINTS** to delete all points in the current mask. The current tolerance mask point under [SF4] becomes POINT # 1 EMPTY.

Creating the upper tolerance mask

- Press **[SF2]** until **UPPER MASK** is visible. This selects the tolerance limit above the measurement trace.
- Press **[SF1]** to open **FREQUENCY** for input.

Note: When the frequency or the level of the tolerance point is open for input, a screen mark becomes visible. Its position in the screen graticule corresponds to the current frequency and level indicated next to [SF1].

- Enter the frequency using the rotary control (quasi-continuous) or with the step keys (for predefined corner values).
- Press **[SF1]** to open **LEVEL** for input.
- Enter the level using the rotary control (quasi-continuous) or with the step keys (for predefined corner values).
- Press **[SF3] INSERT POINT** to generate a tolerance mask point. It will be displayed on the screen at the point which corresponds to the current level and frequency value. The current tolerance mask point under [SF4] changes to POINT # 2 EMPTY.
- Press **[SF1]** to open **FREQUENCY** for input.

Enter the remaining mask points in the same manner.

Creating the lower tolerance mask

- Press **[SF2]** until **LOWER MASK** is visible. This selects the tolerance limit below the measurement trace.

Create the mask points for the lower tolerance limit in the same manner as described above.

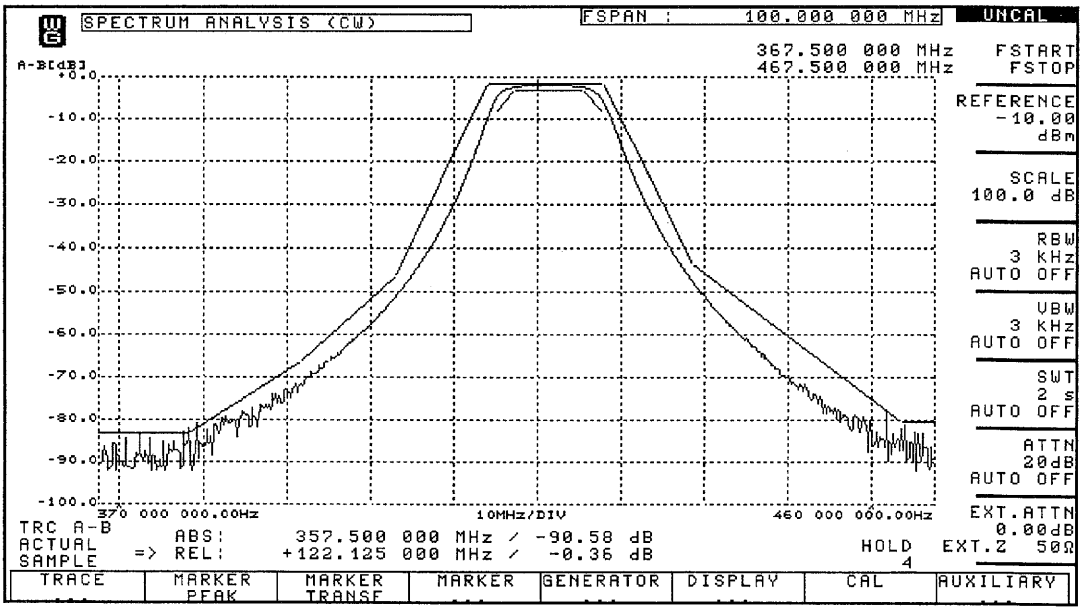


Fig. 4-15 Measurement trace with tolerance mask

Inserting an additional point in the existing tolerance limit

- Press **[SF4]** to open **POINT # n VALID** for input
- Use the keypad --> ENTER or the rotary control to enter the number of the existing point before which an additional point is to be inserted.
- Press **[SF1]** to open **FREQUENCY** for input.
- Enter the frequency using the rotary control (quasi-continuous) or with the step keys (for predefined corner values).
- Press **[SF1]** to open **LEVEL** for input.
- Enter the level using the rotary control (quasi-continuous) or with the step keys (for predefined corner values).
- Press **[SF3] INSERT POINT** to create a new tolerance mask point at the desired location. The remaining points are renumbered accordingly.

Querying points in the existing tolerance limit

- Press **[SF4]** to open **POINT # n VALID** for input
- Use the keypad --> ENTER to specify the number of the existing point for which the values are to be displayed.

Deleting a point in the existing tolerance limit

- Press **[SF4]** to open **POINT # n VALID** for input.
- Use the keypad --> ENTER to specify the number of the point to be deleted.
- Press **[SF5] DELETE POINT** to delete the specified point. The remaining points are renumbered accordingly.

Editing a point in the existing tolerance limit

Insert the new point and delete the old point.

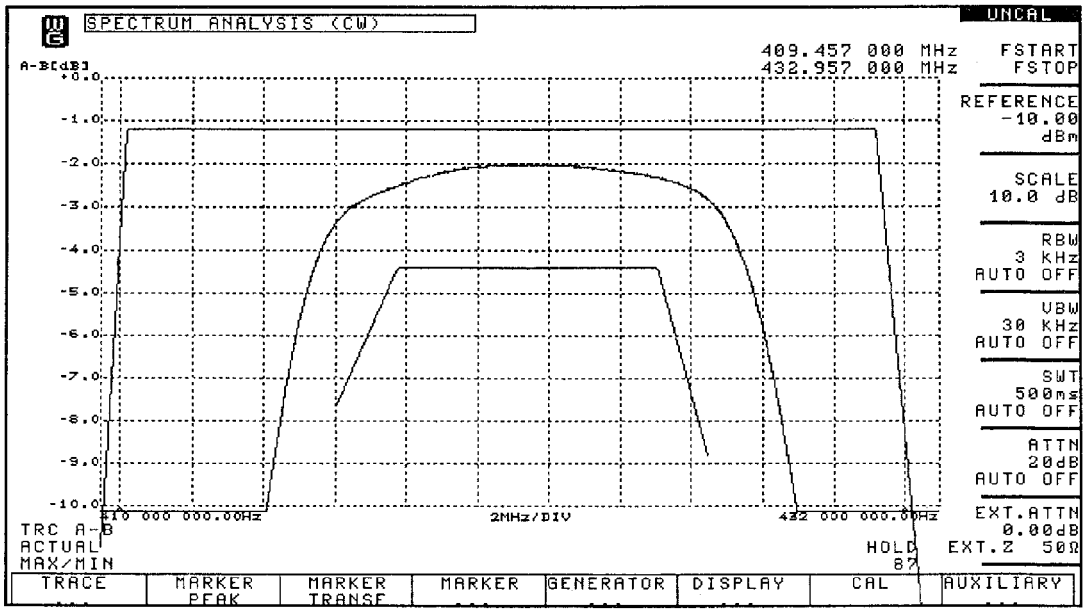


Fig. 4-16 The tolerance mask is recalculated if the scale is changed.

4.3.1.4 Adding a USER TITLE to a measurement screen

- Press the **USER MEM** key.
- Press **[F2]** to open the USER TITLE submenu

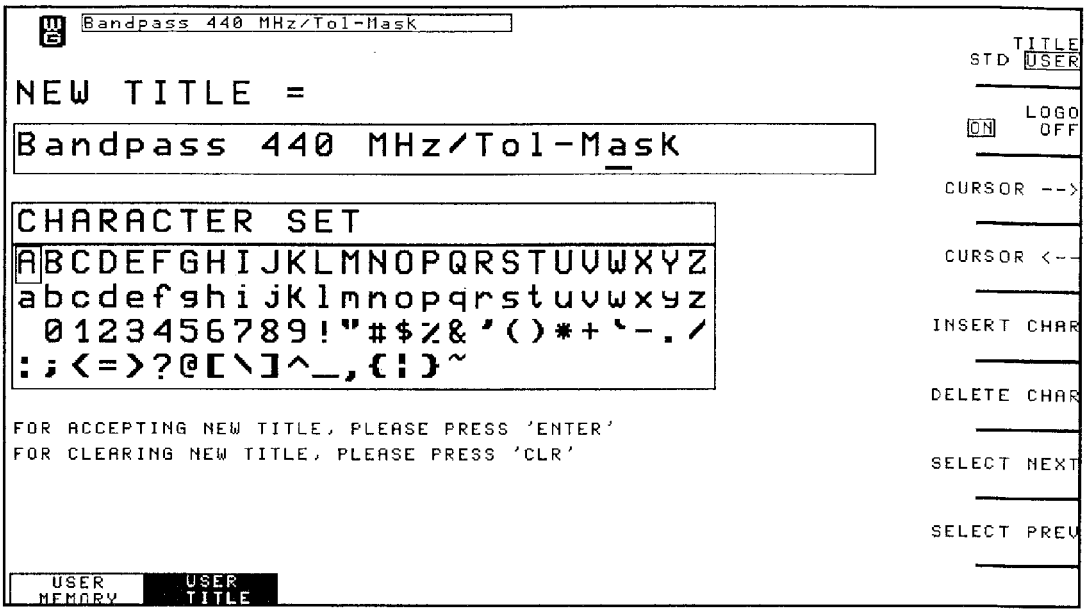


Fig. 4-17 The character set is shown on the screen.

Entering the title

The easiest way to enter the title is by connecting an external keyboard.
Without an external keyboard, however, proceed as follows:

Deleting the entire title

- Press the CLR key.

Inserting a character

- Use **CURSOR -->** or **CURSOR <--** to select the character before which the new character is to be inserted.
- Using the rotary control and step keys or the digit keys, select the character to be inserted in the CHARACTER SET field.
- Press **[SF5] INSERT CHAR**.

Deleting a character

- Use **CURSOR -->** or **CURSOR <--** to select the character to be deleted.
- Press **[SF6] DELETE CHAR** to delete the character above the cursor.

Correcting a character

Insert the new character and delete the incorrect one.

Example: Entering "Bandpass 440 MHz "without an external keyboard

- Use the rotary control and step keys to select **B**.
- Press **[SF5] INSERT CHAR** (the cursor should move to the next location).
- Use the rotary control and step keys to select **a**.
- Press **[SF5] INSERT CHAR**.
- Use the rotary control to select **n**.
- Press **[SF5] INSERT CHAR**.
- Use the rotary control to select **d**.
- Press **[SF5] INSERT CHAR**.
- Use the rotary control to select **p**.
- Press **[SF5] INSERT CHAR**.
- Use the rotary control to select **a**.
- Press **[SF5] INSERT CHAR**.
- Use the rotary control to select **s.**
- Press **[SF5] INSERT CHAR**.
- Press **[SF5] INSERT CHAR**.
- Use the rotary control and step keys to select a **space**.
- Press **[SF5] INSERT CHAR**.
- Press **4** on the keypad.
- Press **4** on the keypad.
- Press **0** on the keypad.
- Press the **M**Hz key.
- Use the rotary control and step keys to select **H**.
- Press **[SF5] INSERT CHAR**.
- Use the rotary control and step keys to select **z**.
- Press **[SF5] INSERT CHAR**.

Field NEW TITLE = accept as new USER TITLE

- Press the ENTER key.

Displaying the USER TITLE

- Press **[SF1]** until TITLE USER is selected.

4.3.1.5 Storing instrument settings as a SETUP

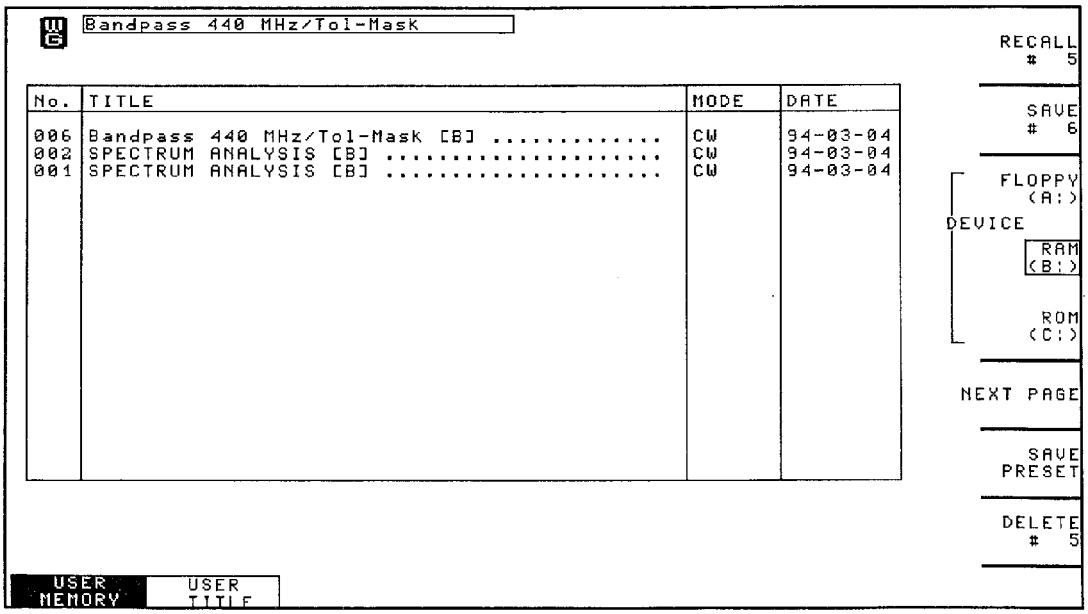


Fig. 4-18 The User Title and the stored B trace can be recognized in the setup.

- Press **[F1]** to open the USER MEMORY submenu.
- Use **[SF4]** or **[SF3]** to select **DEVICE RAM (B:)** or **DEVICE FLOPPY (A:)**, respectively.
- Press **[SF2] SAVE** to open address input for the setup memory.
- Use the keypad --> ENTER to input the address under which the setup is to be stored. If you created a tolerance mask or stored a trace in background memory B, they are stored along with the setup.

Note: If the measurement is halted with the HOLD key, the current measurement trace is also stored in the setup.

- Press the **RTN** key to return to the measurement image.

4.3.1.6 Measuring the 3 dB bandwidth

If necessary, reduce the scale to 10 dB or 25 dB to increase the display resolution.

- Press **[SF3] SCALE** in the main menu to open the scale for input.
- Use the rotary control, step keys or keypad --> ENTER to set the new scale.

If necessary, also modify the reference so that the trace maximum lies closer to the upper edge of the screen.

- Press the **REF** key to open the reference for input. A window showing the current reference value should open above the screen graticule.
- Use the rotary control, step keys or keypad to set the new reference value such that Figure 4-18 results.

Measuring the 3 dB points using the markers

- Press the **Peak** key to place the ABS marker on the highest peak in the trace.
- Press the **Peak** key to activate the REL marker.
- Use the rotary control to move the REL marker down the right skirt until the difference in level with respect to the ABS marker is 3 dB. The bandwidth is then specified positively.
- Press the **MKR** key until the ABS marker is activated.
- Use the rotary control to place the ABS marker on the left filter skirt so that the difference in level compared to the REL marker is 0 dB.

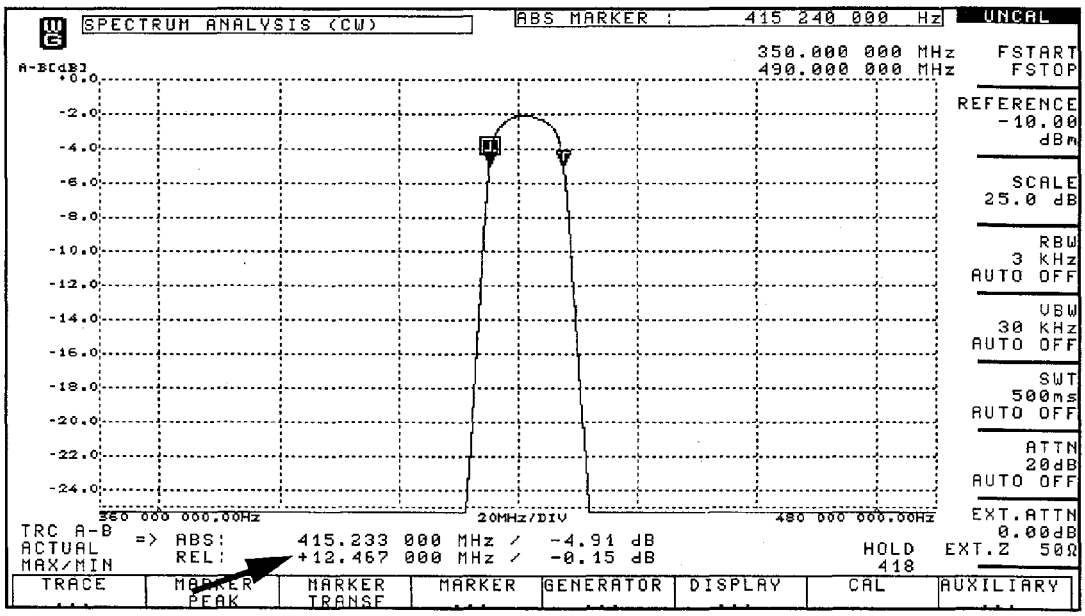


Fig. 4-19 The 3 dB bandwidth is displayed as a frequency difference from the REL marker.

4.3.1.7 Storing multiple settings as a setup (e.g. for series measurements)

If you reduce the frequency range in order to display the trace more precisely in the passband range, the test setup is no longer calibrated. Due to the small overall error of the SNA and TG, however, the displayed results are still sufficiently accurate for many applications. Nonetheless, if you have to make very precise measurements, it is necessary to recompensate for the intrinsic frequency response error after you change the frequency parameters (see 4.3.1.2 on page 4-16). If you must test multiple DUTs with identical characteristics, you can create multiple setups. Each setup contains the special instrument settings along with the compensation values.

Preparations for serial measurements

- Disconnect the DUT and replace it with a coupler (see Fig. 4-13 on page 4-16).

The settings for measuring the overall passband of the DUT are stored in address 1, for example.

The settings for measuring the 3 dB range are stored in the next address (address 2 in this example).

- Connect the DUT (see Fig. 4-12 on page 4-13).

Call up the overview measurement setup:

- Press the **RCL** key.
- Press digit key **1** followed by the ENTER key.

Call up the 3 dB bandwidth setup:

- Press the **STEP-UP** key to call up setup 2.

Connect the next DUT and call up the overview measurement setup:

- Press the **STEP-Down** key to call up setup 1, etc.

4.3.2 Measuring return loss

The return loss of a DUT is measured using a return loss bridge such as the RFZ-6. This device separates the generator signal which passes into the filter from the signal component which the filter reflects back due to mismatch.

Set the frequency range

In this example, the same frequency range is set as in the transmission measurement since the same filter was used for the reflection measurement.

Set the amplitude range

Set the 50 dB amplitude scale since the directivity of a test bridge is at its maximum at approx. 40-50 dB.

- Press **[SF3] SCALE** in the main menu to open the scale for input.
- Use the rotary control, step keys or keypad --> ENTER to set the scale to 50 dB.

Connect the DUT

The filter is connected using the RFZ-6 Return Loss Bridge (for example). The filter is terminated with the system impedance of 50 Ω. The return loss of the termination is measured through the filter. The terminating impedance thus contributes a component to the accuracy (error) of the measurement result.

- Connect the generator output to the IN connector and the receiver output to the OUT connector of the RFZ-6.
- Connect the input of the DUT to the TEST PORT of the RFZ-6.

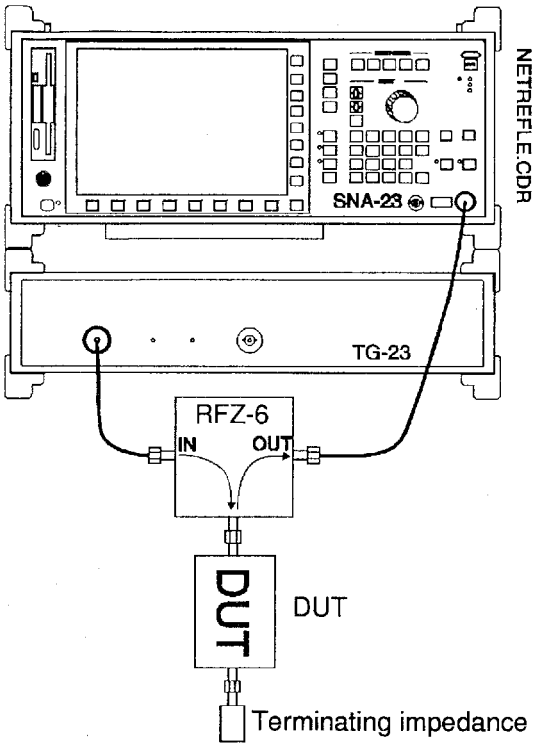


Fig. 4-20 Setup for measuring the return loss

4.3.2.1 Normalizing the test setup

The test bridge has an insertion loss of approx. 6 dB. By way of a reference measurement, this attenuation is taken into account along with the intrinsic frequency response of the test setup.

- During the reference measurement, terminate the TEST PORT connector of the bridge with a reference for total reflection. This reference can be an OPEN CIRCUIT or a SHORT CIRCUIT, which are accessories provided with the RFZ-6.

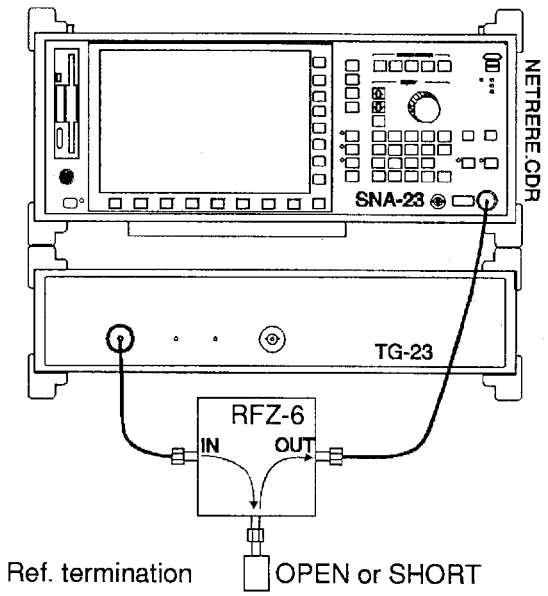


Fig. 4-21 In the reference measurement, the test port of the bridge is terminated with an open circuit or a short circuit.

- Press the **CLEAR TRACE** key to delete the current trace. Wait for a complete sweep pass to run.
- Press **[F1] TRACE...** to open the submenu.
- Press **[F3] TRACE MEMORY** to open the submenu.
- Press **[SF7] STORE A-->B** to store the current parameter settings and the reference values in background memory B.
- Press **[SF4] A-B** so that the difference between screen memory A and the reference measurement in B is measured and displayed.
- Press **[SF5] A-B ZERO POS** until the zero line becomes the uppermost graticule line (TOP).

4.3.2.2 Displaying the measurement trace

- Reconnect the DUT (see Fig. 4-20 on page 4-23). The return loss of the DUT should now be displayed.

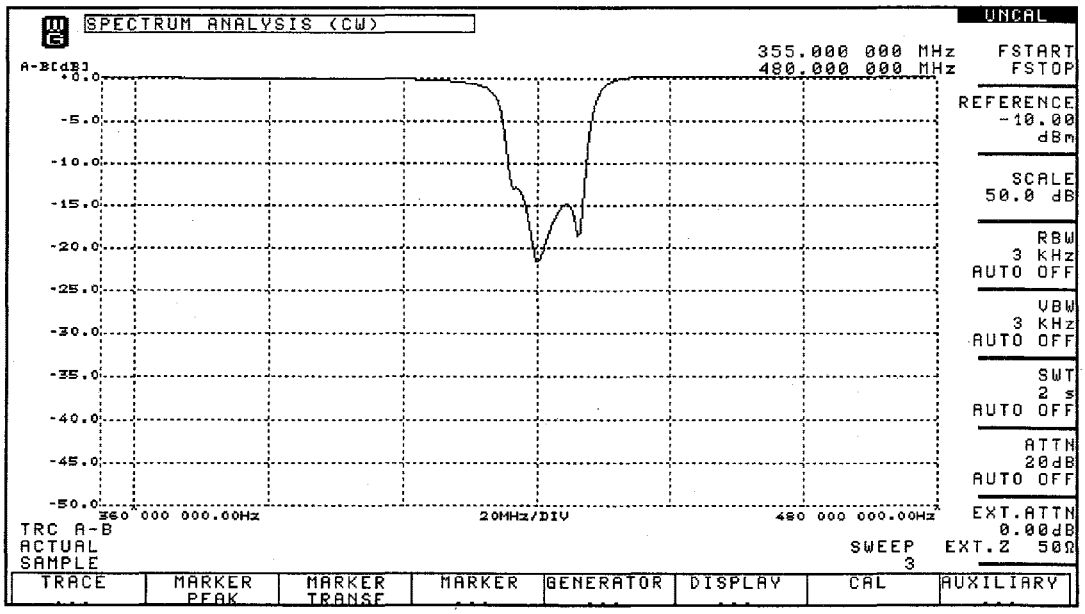


Fig. 4-22 Return loss of the above mentioned bandpass filter

Reduce the amplitude scale if necessary.

- Press **[SF3] SCALE** in the main menu to open the scale for input.
- Use the rotary control, step keys or keypad --> ENTER to set the desired scale.

4.3.2.3 Control measurement with an attenuator

A known return loss can be measured in order to verify that the test setup is functioning properly. You can use a standard mismatch of, say, 20 dB for this purpose. If this is not available, you can also use a "decent" attenuator. The impedance of the attenuator must be the same as the system impedance of the test setup (i.e. 50 Ω if you're not using any adapters on the SNA).

Note: Since the generator signal is attenuated by the attenuator in both directions of transmission (forward and backward), the measured return loss is twice the value specified on the attenuator. Likewise, the error of the attenuator is also doubled.
Example: Given an attenuator specified as 10 dB ± 0.2 dB, you will measure a return loss of 20 dB ± 0.4 dB.

5 Operation

5 Operation

5.1 Controls and connectors on the instrument

All the controls and connectors on the instrument are shown below in table form, together with a brief description of their meanings. The identification numbers used in the table correspond to the numbers on the instrument. Two diagrams with front and rear views of the instrument can also be found in this Description and Operating Manual.

5.1.1 Instrument front panel

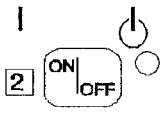
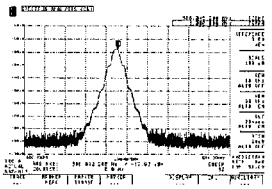
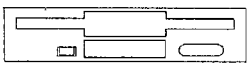
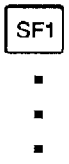
Ident. no.	Control/connector	Meaning
1		*KEYBOARD* 5-pole diode socket for connecting a standard external AT keyboard. This can be used to control all the instrument functions and to enter a USER TITLE.
2		*ON/OFF switch* Used to switch between standby mode and measurement mode. The power switch on the rear of the instrument must be set to I. A delay of 5 s is started each time the switch is pressed, before it responds. The yellow LED lights up in standby mode. The yellow LED remains off in measurement mode.
		*Measurement display* Electroluminescent display with EGA resolution.
		*Diskette drive* 3 1/2"; for reading, writing and formatting diskettes with a capacity of 1.44 MB (HD) or 720 KB (DD) in DOS format.
		*Softkeys, vertical in the right-hand display margin* Used to set the measurement parameters. Their assignment differs according to the current menu. If an external keyboard is used, the SHIFT key must be pressed simultaneously with function keys F1... F8.
		*RETURN key* To exit a submenu and return to the main menu. If an external keyboard is used, the ESC key must be pressed instead.
		*Softkeys, horizontal in the bottom screen margin* Used to select the measurement parameter menus. Their assignment differs according to the current menu. If an external keyboard is used, function keys F1... F8 must be pressed instead.

Fig. 5-1 Controls and connectors on the front of the instrument

Ident. no.	Control/connector	Meaning
3	SET function block	
	PRSET	*Preset* Pressing this key resets all the instrument setup parameters to their initial values (see section 3.3.6); the instrument automatically selects the "SPECTRUM ANALYSIS (CW)" mode.
	MODE	*Operating mode menu* This key opens the operating mode menu, in which the other modes can be selected; the set parameters are not altered if a mode is exited by pressing the MODE key.
	USER MEM	*Setup memory* The setups stored on the A: (diskette in drive), B: (RAM) and C: (ROM) drives are read and listed in a table. An instrument setup with a tolerance mask (T) and a reference curve (B) or a measurement curve can be saved, recalled or deleted by pressing the softkeys and entering the setup number.
	RCL	The "RCL" key corresponds to the "RECALL" softkey in the USER MEM menu. It can be pressed to display the instrument setups of the selected DEVICE (of the diskette in the A: drive, of the RAM disk, B: drive, or of the ROM, C: drive).
	RCL 5	*Recall setups* Pressing the RCL key opens a window above the graticule. The window contains the number of the last setup to have been displayed. If you now press the '5' key and confirm it with ENTER, setup no. 5 will be recalled.
	RCL ⇩	*Recall the next lower setup* The setup number is decremented by one and the setup is displayed.
	RCL ⇧	*Recall the next higher setup* The setup number is incremented by one and the setup is displayed.
4	DIRECT SETTING function block	The actions of the keys in the DIRECT SETTING block are independent of the currently displayed menu. Pressing one of these keys opens an input line above the graticule. This line can be cleared again either by pressing the ENTRY OFF key or by making another input. The frequency limits are set with FCENT/FSPAN, irrespective of the current scale divisions.
	FCENT	*Center frequency* This key opens the input line for a new center frequency.
	FSPAN	*Frequency span* This key opens the input line for a new frequency span.
	REF	*Reference level* This key opens the input line for a new reference level.

Fig. 5-1 Controls and connectors on the front of the instrument

Ident. no.	Control/connector	Meaning
	MKR	*Marker functions* This key activates the ABS marker (MARKER ON) the first time it is pressed and opens either a display field with the current ABS marker frequency or an input line for a new ABS marker frequency above the graticule. The second time the key is pressed, it activates the REL marker as well and opens an input line for the REL marker frequency. The key acts as a toggle between the ABS and REL markers.
	PEAK	*Marker peak functions* - If no markers or only the ABS marker are open for inputs: sets the ABS marker to the HIGHEST PEAK. - If both the ABS marker and the REL marker are open for inputs: sets the ABS and REL markers to the HIGHEST PEAK. - If the ABS marker is set to the HIGHEST PEAK and the REL marker is active: sets the REL marker to the NEXT PEAK.
	FCENT + MKR	*TRANSFER center frequency* If you press the FCENT key first and hold it down while simultaneously pressing the MKR key, the current marker frequency is accepted and set as the new center frequency. This is a good idea if you have set the marker to a peak value and want to reduce FSPAN, for example.
	FSPAN + MKR	*TRANSFER frequency span* If you press the FSPAN key first and hold it down while simultaneously pressing the MKR key, the range between the ABS MKR and the REL MKR is accepted and set as the new frequency span. You can thus define the start frequency with the ABS marker and the stop frequency with the REL marker.
	REF + MKR	*TRANSFER reference value* If you press the REF key first and hold it down while simultaneously pressing the MKR key, the marker level value is accepted and set as the new reference value. The marker is then visible on the top line of the graticule and you are able to use the entire scale to represent your measurement curve.

Fig. 5-1 Controls and connectors on the front of the instrument

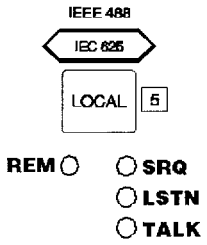
Ident. no.	Control/connector	Meaning
5	EEEE 488/<IEC 625> function block 	*Change to manual mode* Pressing the LOCAL key switches the instrument over from remote control to manual mode. The four LEDs below the key indicate the IEEE/IEC status of the instrument. REM The red LED lights up if the instrument is currently in remote control mode. Manual mode can be selected by pressing the LOCAL key or by programming GTL (go to local). The LOCAL key has no function if LOCAL LOCKOUT has been programmed. SRQ The yellow LED lights up if the SNA issues a SERVICE REQUEST. LSTN The green LED lights up if the SNA is activated by an external bus device (e.g. a controller) or if it receives data. TALK The green LED lights up if the SNA sends data to an external bus device (e.g. a controller).
6	ENTRY function block	Selected parameters can be altered using the numeric keypad, in steps using the STEP keys or quasi-continuously/in detent steps using the rotary control. A selected parameter can be altered in steps using the arrow keys. The frequency/level step width can be set individually with FSTEP (in the DISPLAY/FREQUENCY SCALE submenu) and LSTEP (in the DISPLAY/LEVEL AXIS submenu). The step width is fixed for all other parameters, e.g. SCALE, RBW, etc.
		*To increase the parameter value*
		*To reduce the parameter value*
		*Automatic function for coupled ON/OFF parameters* The following parameters can be matched to the sweep span for spectrum analysis: - Resolution bandwidth RBW - Video bandwidth VBW - Sweep time SWT - Frequency step width FSTEP (linear scale only) The following parameter can be matched to the reference level (REFERENCE): - Input attenuation INPUT ATTN The following parameter can be matched to the scale division: - Level step width LSTEP

Fig. 5-1 Controls and connectors on the front of the instrument

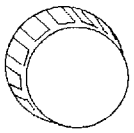
Ident. no.	Control/connector	Meaning
		*Rotary control* A numeric parameter which has been selected for a data input can be altered quasi-continuously using the rotary control. If a step width has been defined (e.g. for SCALE, RBW, SWT), the parameter is altered one step at a time.
	7 8 9 4 5 6 1 2 3 0 . -	*Numeric keypad* Used to enter numeric values for parameters. If a fixed step width has been defined (e.g. for SCALE, RBW, SWT), the input is rounded up or down to the nearest valid value. Period = decimal point Minus = negative sign
	G/n M/µ k/m	*Unit with ENTER function* the unit of measurement for the frequency (gigahertz, megahertz or kilohertz), the time (ms, s) or the voltage (nV, V, mV) is assigned to the numeric value which has been entered. These keys have an ENTER function.
	ENTER	*ENTER key* This key terminates numeric inputs with a multiplier action of 1 (e.g. Hz, s, V, dB).
	CLR	*Clear value* the complete numeric value of the selected parameter is cleared.
	⇦DEL	*Delete last digit* This key deletes the entered digits one at a time, providing the parameter input has not been terminated by pressing ENTER.
	ENTRY OFF	*Close open parameter input* The frame around the selected parameter disappears
8	RUN function block	*Start sweep*
	○ SWEEP	This key starts the sweep. The sweep conditions are defined in the AUXILIARY/SWEEP MODE menu.
	○ MAN	*Show current amplitude* This key interrupts the sweep. The last measurement frequency to have been entered is displayed together with the current measured amplitude. This key also opens an input line for a discrete measurement frequency, to which the instrument is tuned. Resolution with: - Numeric keypad or STEP keys: 0.1 Hz - Rotary control: FSPAN/1 000
	○ HOLD	*Hold sweep* This key stops the sweep and the measurement; the contents of the display are not altered any more. If a setup is saved in this instrument status, it includes the measurement curve.

Fig. 5-1 Controls and connectors on the front of the instrument

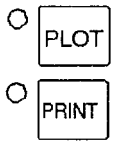
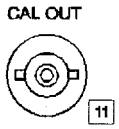
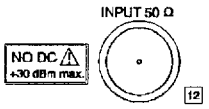
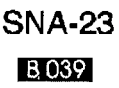
Ident. no.	Control/connector	Meaning
		*Clear current results* The measurement frequency is reset to FSTART.
9	ZOOM function block	
		*ZOOM IN* The frequency range is stretched around the ABS marker.
		*ZOOM OUT* Pressing this key "unstretches" the frequency range one step at a time.
10	HARD COPY function block	
		*Print* This key starts a printout of the current display contents to a pixel-oriented device (e.g. a printer). The LED lights up for the duration of the printout.
11		*Calibration source* Output of the built-in fixed-frequency calibration source. The 22 MHz signal, which has a level of -30 dBm, is only active during the external calibration procedure. This can be started by pressing SF3, "EXECUTE EXT. CAL" in the "CAL" submenu (F4). The output of the calibration source must be directly connected to the test port in order to calibrate.
12		*Test port* SNA-20: 9 kHz to 3.2 GHz SNA-23: 9 kHz to 26.5 GHz; If the "narrow-band filters" option is installed, the lower limit frequency is 100 Hz. Zo = 50 Ω. Exchangeable precision connector (EPC) for the SNA-23, fitted with insert for PC 3.5 (male) or N (female).
		*Instrument type and series number*

Fig. 5-1 Controls and connectors on the front of the instrument

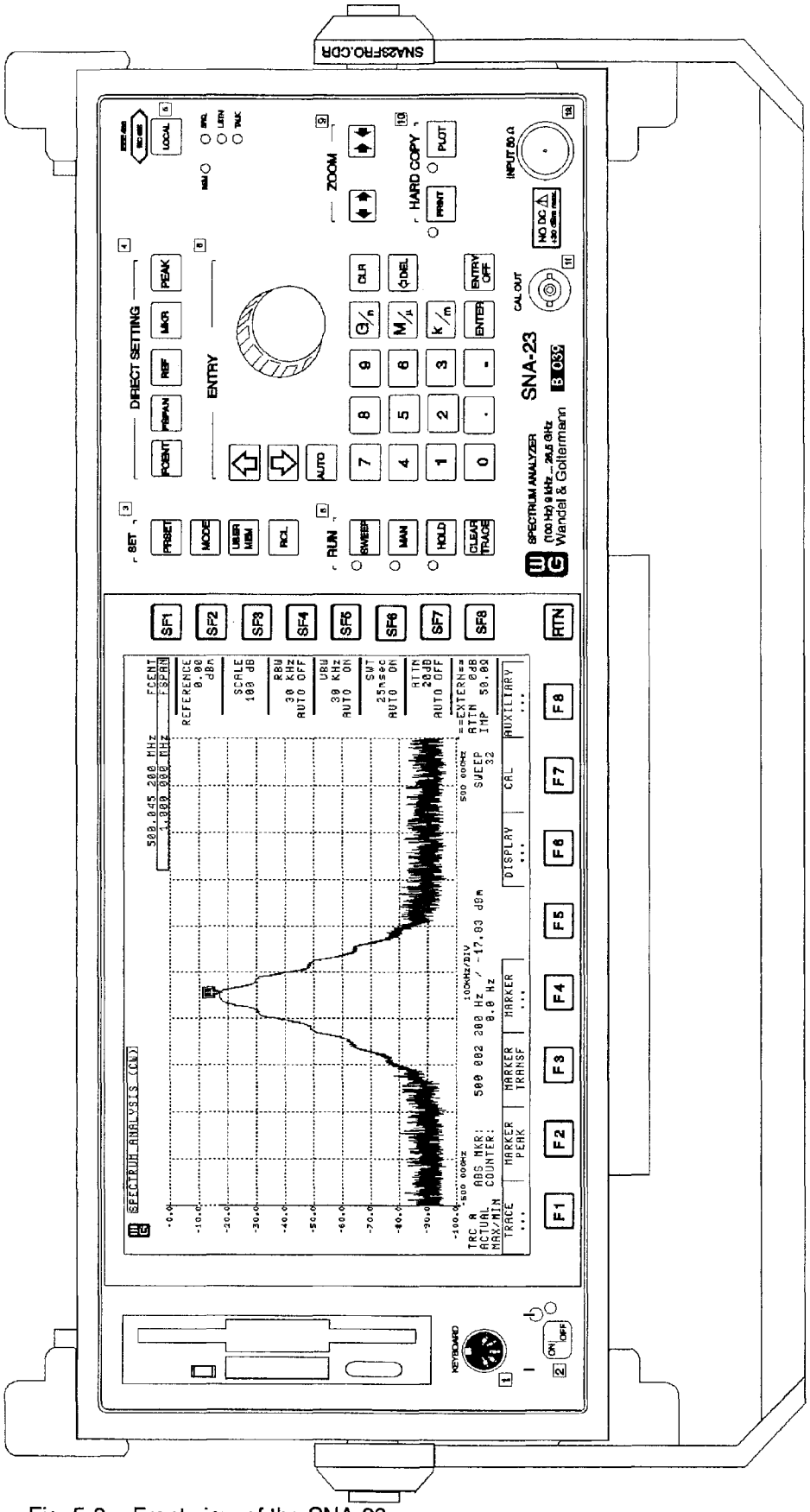


Fig. 5-2 Front view of the SNA-23

5.1.2 Back panel of the SNA

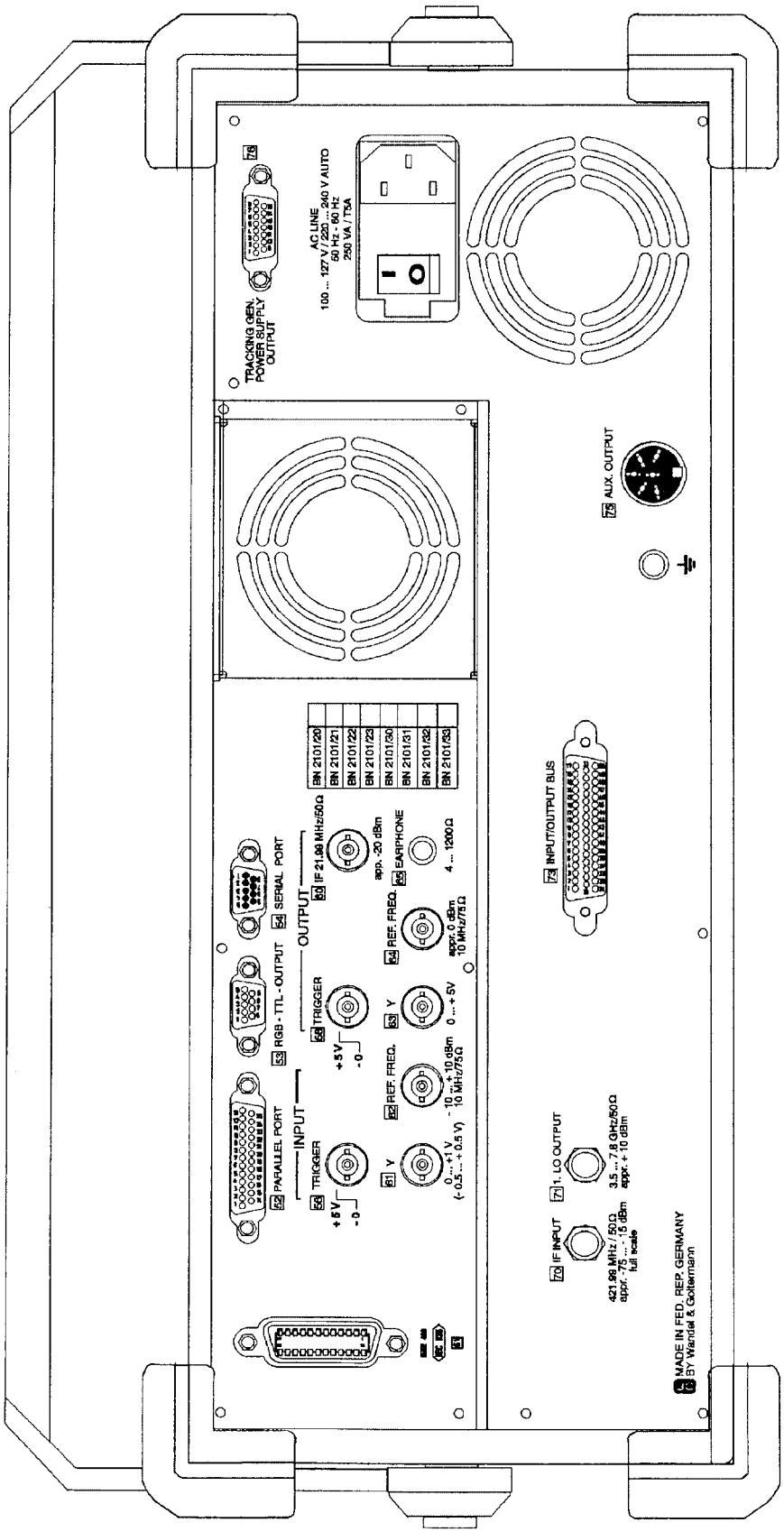


Bild 5-3 Rear view of the SNA-23

Instrument rear

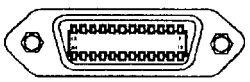
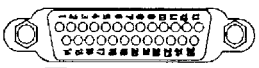
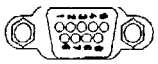
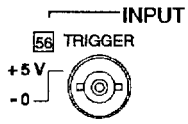
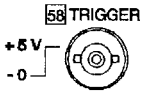
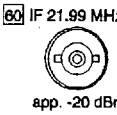
Ident. no.	Control/connector	Meaning
51		*IEEE 488/IEC 625* 24-pole Amphenol connector (IEEE 488) for controlling all the instrument functions and displaying the results.
52	 52 PARALLEL PORT	*PARALLEL PORT* 25-pole SUB-D connector. Parallel interface (Centronics) for connecting a printer.
53	 53 RGB - TTL - OUTPUT	*RGB-TTL-OUTPUT* 9-pole SUB-D connector for an EGA monitor. The monitor must have TTL inputs. Assignment: Pin 1: Ground Pin 2: Red LSB Pin 3: Red MSB Pin 4: Green MSB Pin 5: Blue MSB Pin 6: Green LSB Pin 7: Blue LSB Pin 8: H-sync Pin 9: V-sync (negative)
54	 54 SERIAL PORT	*SERIAL PORT* 9-pin SUB-D connector. RS 232 interface for controlling a printer or a graphics plotter. Assignment: Pin 1: Not used Pin 2: Rx Pin 3: Tx Pin 4: DTR Pin 5: Ground Pin 6: DSR Pin 7: RTS Pin 8: CTS Pin 9: Not used
56	 INPUT 56 TRIGGER +5 V -0	*INPUT TRIGGER* BNC input for external triggering, TTL level. Input impedance 100 kΩ/10 pF.
58	 58 TRIGGER +5 V -0	*OUTPUT TRIGGER* BNC trigger output, Z = typ. 1 kΩ
60	 60 IF 21.99 MHz/50Ω app. -20 dBm	*OUTPUT IF 21,99 MHz/50 Ω* BNC output for the intermediate frequency 21,99 MHz/50 . If the reference level is displayed, the output level is -20 dBm/R_L = 50Ω.

Fig. 5-4 Controls and connectors on the rear of the instrument

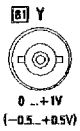
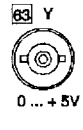
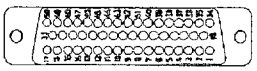
Ident. no.	Control/connector	Meaning
61		*INPUT Y* For injecting an external Y voltage; voltage range either 0 ... 1 V or -0.5 ... +0 5 V (programmable). Impedance typ. 1 kΩ.
62		*INPUT REF. FREQ.* BNC input for external reference frequencies (10 MHz). Input level -10 to +10 dBm/75 Ω. The internal reference frequency generator is synchronized with the input signal if the frequency deviation is $< 1 * 10^{-6}$.
63		*OUTPUT Y* The DC voltage which is available at this BNC connector changes proportionally to the Y sweep of the measurement curve. Impedance approx. 10Ω, voltage range 0 to +5 V.
64		*OUTPUT REF. FREQ.* BNC output for the internal reference frequency (10 MHz); output level approx. 0 dBm/75 Ω.
65		*EARPHONE* Earphone output for the built-in AM/FM demodulator. 3.5 mm jack socket with mono output voltage U_{rms} = 1.2 V typ. on both channels with a modulation depth of 80%. Volume adjustable in the AUXILIARY/DEMODULATOR menu with the "VOLUME EARPH" softkey.
70		*IF-INPUT 421,99 MHz* Input for the 421.99 MHz intermediate frequency; SMA socket, e.g. for connecting an external mixer. Level range for the full scale deflection of the result display -75 ... -15 dBm. If an external mixer is used, its mixer diode can be supplied with a digitally settable bias current of -12.8 ... +12.8 mA via this input.
71		*1. LO-OUTPUT* Output of the local oscillator; frequency 3.5 ... 7.8 GHz, nominal level +10 dBm/50 Ω. Tap line terminated with 50 Ω SMA connector. The output must always be terminated during operation.
73		*INPUT/OUTPUT BUS* 50-pole SUB-D connector, e.g. for controlling W&G tracking generators.
75		*AUX. OUTPUT* 6-pole diode connector for connecting accessories. Assignment: Pin 1 = Not used Pin 2 = Not used Pin 3 = +5 V/0.5 A max. Pin 4 = +15 V/0.35 A max. Pin 5 = -12 V/0.1 A max. Pin 6 = Ground of power supply unit/frame

Fig. 5-4 Controls and connectors on the rear of the instrument

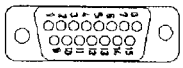
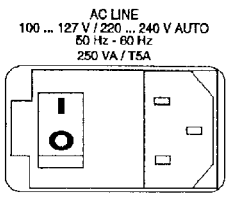
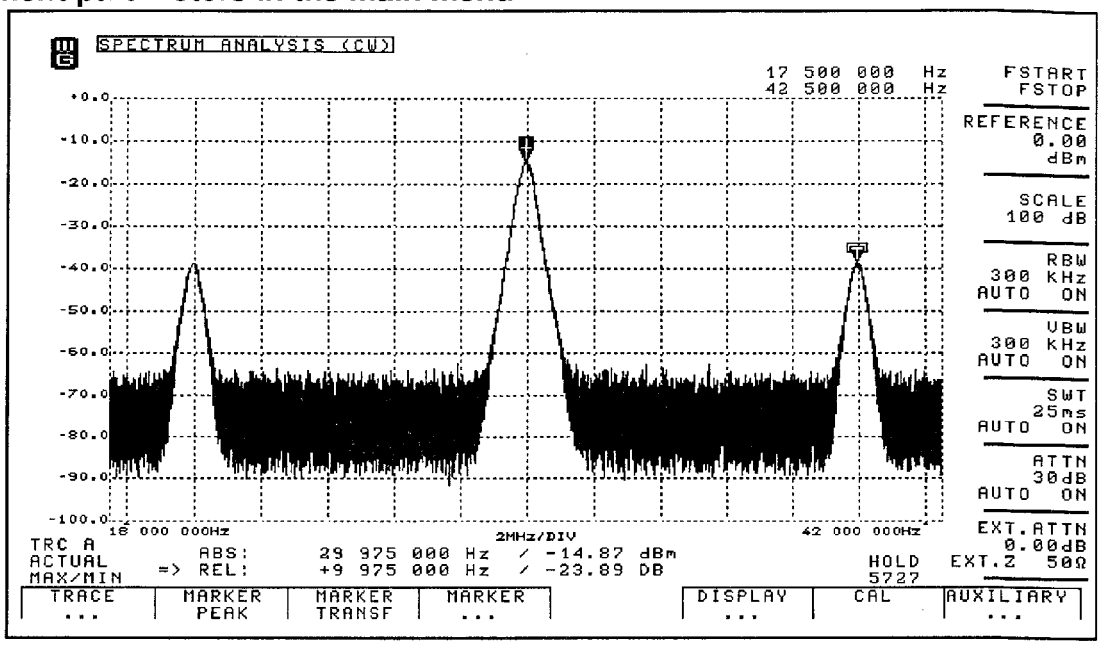
Ident. no.	Control/connector	Meaning
76		*TRACKING GEN. POWER SUPPLY OUTPUT* 15-pole SUB-D connector for supplying external generators with power.
		*Ground socket*
		*Power switch for activating the power supply unit* A.C. line voltage connection for non-heating appliance plug 90 ... 240 V a.c. Power ON: Switch position **I** Power OFF: Switch position **O**

Fig. 5-4 Controls and connectors on the rear of the instrument

5.2 Measurement parameters in the main menu



5.2.1 FCENT, Center frequency

Meaning

Center frequency = arithmetic mean of the limit frequencies over the displayed range (FSPAN). FCENT/FSPAN scaling is not recommended in connection with a logarithmic axis.

Open input

With "FCENT" key or **[SF1]** in the main menu; toggle with the sweep span (FSPAN)

Setting range

	Linear frequency axis	Logarithmic frequency axis
SNA-20	0 ... 3.2 GHz	Approx. 1/2 (FSTOP-FSTART) ... 3.2 GHz
SNA-23	0 ... 30.0 GHz	Approx. 1/2 (FSTOP-FSTART) ... 30 GHz

Set with

Rotary control

Resolution FSPAN/500 (when FSPAN = 0, resolution RBW/50)

Step keys

FSTEP

Numeric keypad --> [ENTER]

Resolution 1 Hz

Marker transfer

SIGNAL TRACK

Default setting

1.569 995 500 GHz

5.2.2 FSPAN, Frequency span

Meaning

Sweep span = frequency range which is covered by the analyzer measurements.

Open input

With "**FSPAN**" key or **[SF1]** in the main menu; toggle with FSTART and FCENT

Setting range

	Linear frequency axis	Logarithmic frequency axis
SNA-20	0 ... 3.2 GHz	FSTART*(10^6-1)
SNA-23	0 Hz, 1 Hz... 30.0 GHz	0 ... (FSTOP+FSTART* (1-2*10^{-6}))

Set with

Rotary control
Resolution 1-2-5 steps
Step keys
Resolution FSTEP
Numeric keypad --> [ENTER]
Resolution 1 Hz
Marker transfer

Default setting

3.139 991 000 GHz

5.2.3 FSTART, Start frequency

Meaning

Start frequency = frequency at the lower end of the set frequency range.

Note: This frequency can only be set if START/STOP or START/SPAN has been selected as the frequency scale in the DISPLAY, FREQUENCY AXIS menu.

Open input

With **[SF1]** in the main menu; toggle with FSTOP and FSPAN

Setting range

SNA-20	0 ... 3.2 GHz
SNA-23	0 ... 30.0 GHz

Set with

Rotary control
Resolution for FSTART/FSPAN --> FSPAN/500
for FSPAN = 0 --> RBW/50
Resolution for FSTART/FSTOP --> 1-2-5 steps
Step keys
Resolution FSTEP
Numeric keypad --> [ENTER]
Resolution 1 Hz
Marker transfer

Default setting

9.0 kHz

5.2.4 FSTOP, Stop frequency

Meaning

Stop frequency = frequency at the upper end of the set frequency range.

Note: This frequency can only be set if START/STOP has been selected as the frequency scale in the DISPLAY, FREQUENCY AXIS menu.

Open input

With **[SF1]** in the main menu; toggle with FSTART

Setting range

SNA-20	0 ... 3.2 GHz
SNA-23	0 ... 30.0 GHz

Set with

Rotary control
Resolution 1-2-5 steps
Step keys
Resolution FSTEP
Numeric keypad --> [ENTER]
Resolution 1 Hz
Marker transfer

Default setting

3.14 GHz

5.2.5 REFERENCE, Reference value

Meaning

Maximum expected input level (full scale deflection). The setting of the input divider is dependent on the REFERENCE if "ATTN AUTO ON" is also set. If a relative amplitude scale is used (set with SF3 in the DISPLAY, LEVEL AXIS menu), REFERENCE corresponds to the zero line of the graticule. The unit of measurement can be selected in the DISPLAY/LEVEL UNITS menu.

Open input

With "**REF**" key or **[SF2]** in the main menu

Setting range

All values which correspond to an amplitude of -150.00 ... +30.00 dBm at the input socket.

Set with

Rotary control
Resolution LSTEP
Step keys
Resolution LSTEP
Numeric keypad --> [ENTER]
Resolution 0.01 dB
Marker transfer

Default setting

0.00 dBm

5.2.6 SCALE, Amplitude scale

Meaning

Range of the amplitude axis.

Note: SF2 in the DISPLAY/LEVEL AXIS menu determines whether the measurement is to be logarithmic or linear (proportional to the voltage). The axis division is automatically matched to this setting. SF3 in the same menu toggles between absolute and relative amplitude scaling (referred to REFERENCE). The unit of measurement can be selected in the DISPLAY/LEVEL UNITS menu.

Open input

With **[SF3]** in the main menu

Setting range

Linear scale 100% (fixed)
Logarithmic scale 1 ... 100 dB

Set with

Rotary control
Resolution 1-2.5-5 steps in the range from 1 to 100 dB
Step keys
Resolution 1-2.5-5 steps in the range from 1 to 100 dB
Numeric keypad --> [ENTER]
0.1 dB in the range from 1 to 100 dB

Default setting

100 dB

5.2.7 RBW, Resolution bandwidth

Meaning

3 dB resolution bandwidth of the IF filters. The filters up to 3 MHz have an approximately Gaussian characteristic, while the curve of the 10 MHz filter (6 dB bandwidth) is practically square-wave.

Note: This setting is automatically coupled with the frequency span (FSPAN) if AUTO ON is also set. The automatic function sets the best possible compromise between a short sweep time, an optimum transient response and an ideal dynamic behavior.
If AUTO ON set: RBW = approx. FSPAN/100.

Open input

With **[SF4]** in the main menu

Setting range

1 kHz ... 10 MHz

Set with

AUTO key
Automatically coupled with FSPAN (ON/OFF)
AUTO OFF if RBW altered using:
- Rotary control, - Step keys
Resolution 1-3 steps
- Numeric keypad --> [ENTER]
Resolution 1-3 steps

Default setting

10 MHz/AUTO ON

5.2.8 VBW, Video bandwidth

Meaning

Limit frequency of the low-pass filter downstream of the amplitude rectifier. It allows the representation of noisy signals to be smoothed.

Note: VBW is automatically coupled with RBW if AUTO ON is set as well (VBW = RBW). The automatic function sets VBW to as low a value as possible; there must not be any transient errors as a result of VBW, however.

Open input

With **[SF5]** in the main menu

Setting range

3 Hz ... 10 MHz

Set with

AUTO key
Automatically coupled with RBW (ON/OFF)
AUTO OFF if VBW altered using:
- Rotary control
Resolution 1-3 steps
- Step keys
Resolution 1-3 steps
- Numeric keypad --> [ENTER]
Automatic rounding to 1-3 steps

Default setting

10 MHz/AUTO ON

5.2.9 SWT, Sweep time

Meaning

Duration of one sweep between FSTART and FSTOP. A setting time must be added to the sweep time if the receive frequency band is changed.

Note: Note: The automatic function sets the best possible compromise between a short sweep time and optimum noise averaging without transient errors. SWT is automatically coupled with RBW and VBW if AUTO ON is also set, according to the following formulae: SWT ≥ k1 * FSPAN/RBW and SWT≥ k2 * FSPAN/(RBW * VBW).

Open input

With **[SF6]** in the main menu

Setting range

25 ms ... 72 000 s (20 h)

Set with

AUTO key
Automatically coupled with FSPAN, RBW and VBW (ON/OFF)
AUTO OFF if SWT altered using:
- Rotary control, step keys
Resolution 1-2-5 steps
- Numeric keypad --> [ENTER]
Resolution 1 ms

Default setting

25 ms

5.2.10 ATTN, Input attenuation

Meaning

Attenuation of the measurement signal at the input socket. The input signal is matched to the maximum deflection of the mixer by the input attenuator. If "AUTO ON" is also set, the input divider is adjusted so that the intrinsic noise and the intermodulation products are of a roughly equal magnitude when the load applied is ≤ REFERENCE (optimum dynamic behavior).

Open input

With **[SF7]** in the main menu

Setting range

0 ...65 dB

Set with

AUTO key
Automatically coupled with RBW and REFERENCE (ON/OFF)
AUTO OFF if ATTN altered using:
Rotary control, step keys,
Resolution 5 dB in the range from 5 to 65 dB
numeric keypad --> [ENTER]
Resolution 5 dB in the range from 0 to 65 dB

Default setting

40 dB/AUTO ON

5.2.11 EXTERN ATTN/EXTERN Z, Allowances for external adapters

Meaning

Certain types of measurement require the device under test to be connected to the test port either via an adapter or attenuator (positive attenuation) or via an amplifier (negative attenuation).
If the parameters of the adapter or attenuator are entered correctly, all the values will refer to its input.
EXTERN ATTN permits account to be taken of the value of the attenuation or gain, while EXTERN Z allows for the impedance of the intermediate two-port network. The power attenuation must always be entered. If only the voltage attenuation is known, the power attenuation can be determined using the following formula:
Power attenuation = voltage attenuation - 10 log (IMP/50 Ω).

Open input

With **[SF8]** in the main menu; toggle between
EXTERN ATTN and
EXTERN Z

EXTERN ATTN

Setting range

The level at the input socket must be between -150 dB and +30 dB

Set with

Rotary control, step keys
Resolution LSTEP
Numeric keypad --> [ENTER]
Resolution 0.01 dB
Positive --> attenuation
Negative --> gain

Default setting

0.00 dB

EXTERN Z

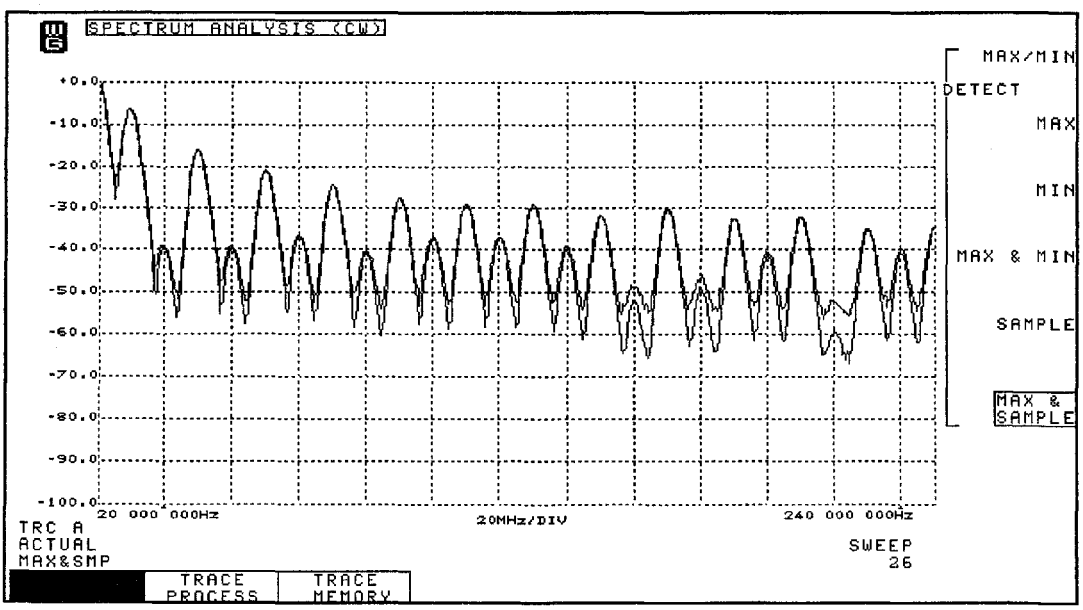
Setting range 20 Ω ... 3200 Ω

Set with
Rotary control
Resolution 5 Ω
Step keys
Resolution 5 Ω
Numeric keypad --> [ENTER]
Resolution 1 Ω

Default setting 50 Ω

5.3 TRACE, Saving and processing amplitude values and representing the measurement curve(s)

5.3.1 TRACE DETECT



Meaning Select detection type

This function determines how the input amplitude is measured. The total frequency range is subdivided into 1000 subranges for recording the measured values. A large number of values are detected within this window. Only two of them are saved, however, depending on the TRACE DETECT setting:
- MAX - the highest value which has been measured
- Either MIN (the lowest value) or SAMPLE (the final value)

The results which are saved are compressed to 500 pixels before they are represented on the display.
MAX/MIN = The minimum and maximum values of the measured level are detected within a frequency measurement window. The two pixels at which these values are located are joined together on the measurement curve (barrage noise).
MAX = Only the maximum value in the measurement window is shown.

MIN = Only the minimum value in the measurement window is shown.
MAX&MIN = Both the minimum and maximum values of the measured level are detected. The two pixels at which these values are located are joined to the other MAX and MIN values on the measurement curve. Two separate measurement curves are thus displayed.

SAMPLE = The final value in the measurement window is detected.

MAX&SAMPLE = The maximum value in the measurement window is detected together with the final measured value. The two pixels at which these values are located are joined to the other MAX and SAMPLE values on the measurement curve. Two separate measurement curves are thus displayed.

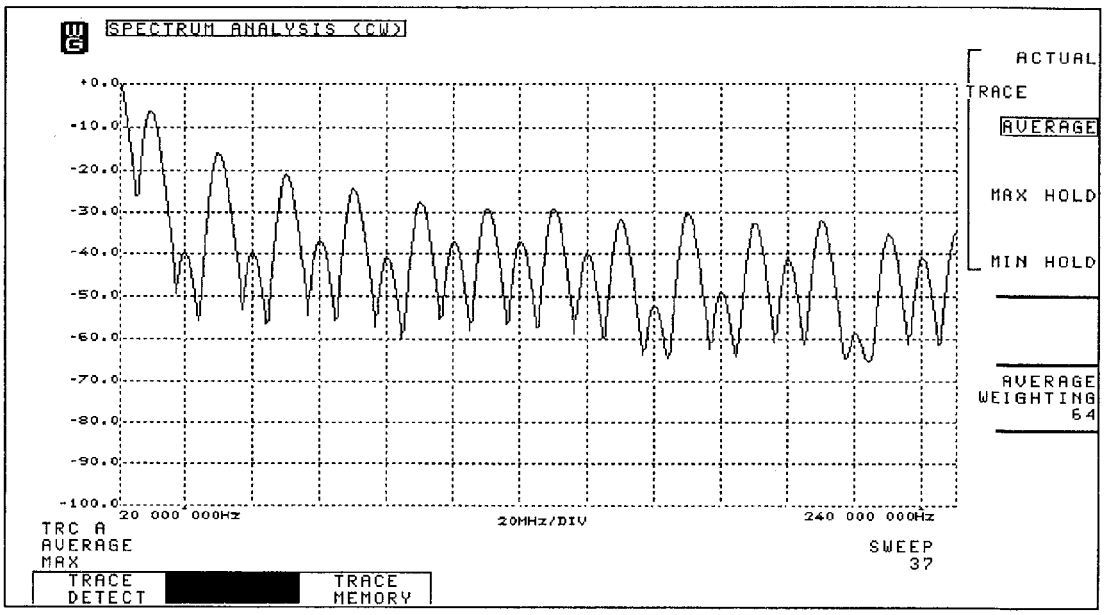
Make choice

With **[SF1]** = MAX/MIN
[SF2] = MAX
[SF3] = MIN
[SF4] = MAX&MIN
[SF5] = SAMPLE
[SF6] = MAX&SAMPLE

Default setting

MAX/MIN

5.3.2 TRACE PROCESS, Process amplitude values



5.3.2.1 TRACE PROCESS ACTUAL / AVERAGE / MAX HOLD / MIN HOLD

Meaning

Process amplitude values

This function determines how the stored input amplitudes are processed. The pixels are entered at the end of the frequency sampling interval.
ACTUAL = Show the actual measured values. Each sweep causes the actual measured values to overwrite the complete contents of the display memory A. Any change in the input signal is visible on the display immediately.
AVERAGE = Form the digital mean value for the previous measurements and show it on the display.

The AVERAGE function reveals spectral lines which would otherwise be concealed by noise.
If the AVERAGE function is active, the contents of the display memory A are determined not merely by the actual input signal, but also by the information content of this signal and its history:

- If the display memory has been cleared (with /CLEAR TRACE/) or if it is no longer valid (because important measurement parameters have been altered or a change has been made from ACTUAL to AVERAGE), the complete actual input signal is transferred to the display memory at the time of the first sweep (the cycle counter changes from 0 to 1); it can then be used for reference purposes when subsequent sweeps take place. "AVRG/1" means that the input signal is given a weighting of 1 for the display memory.
- Each time a new sweep takes place, the new results are weighted with the currently displayed results, whereby the ratio is 1/n to (n-1)/n (where n is the number of the sweep, max. AVERAGE WEIGHTING).
  Example: AVERAGE WEIGHTING = 4
  1st sweep: result = new result
  2nd sweep: result = 1/2 new result + 1/2 old result
  3rd sweep: result = 1/3 new result + 2/3 old result
  4th sweep and all subsequent sweeps: result = 1/4 new result + 3/4 old result.

MAX HOLD = The actual measured values only overwrite the contents of the memory if they are higher than them. The MAX HOLD function allows the maximum level values which have occurred during an observation period to be recorded. This is useful for representing the envelope spectrum of a pulse-shaped input signal or the drift measurement of an oscillator, as well as for tracing spurious and random noise signals (long-time monitoring).
MIN HOLD = The actual measured values only overwrite the contents of the memory if they are lower than them. The MIN HOLD function allows generator failures or pilot frequencies to be recorded, for example.

Note: If AVRG, MAX HOLD or MIN HOLD is active, the number of sweeps (REPEAT SINGL SWEEP n TIMES) must be set as appropriate for SWEEP SINGL.

Make choice

With **[SF1]** = ACTUAL
[SF2] = AVERAGE
[SF3] = MAX HOLD
[SF4] = MIN HOLD

Default setting

ACTUAL

5.3.2.2 AVERAGE WEIGHTING

Meaning

AVERAGE weighting factor

If the AVERAGE function is active (see TRACE PROCESS), the contents of the display memory A are determined not merely by the actual input signal, but also by the information content of this signal and its history.

Open input

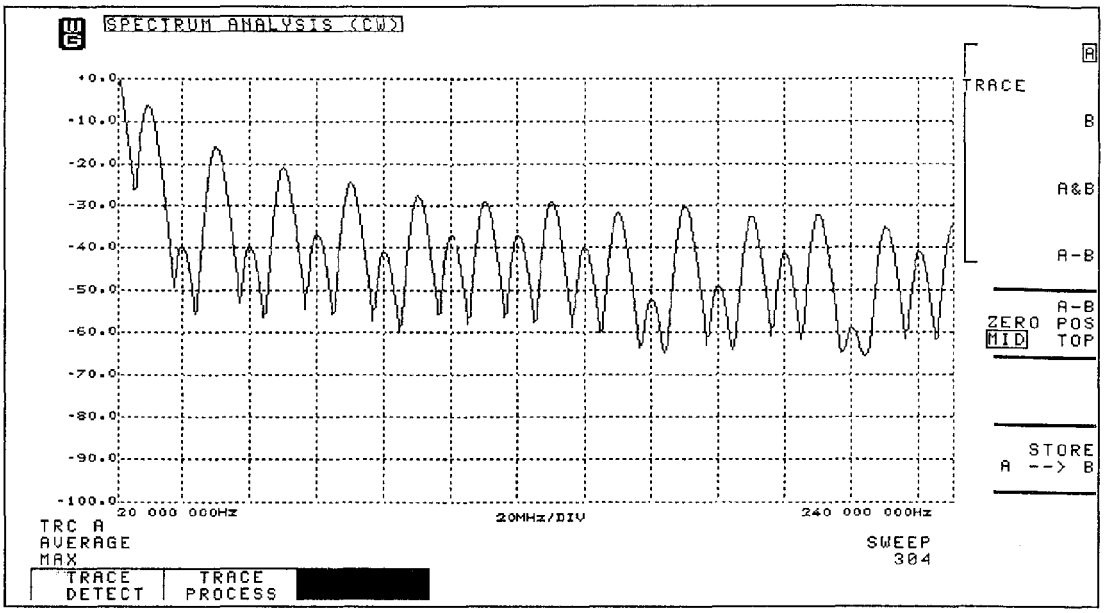
With **[SF6]**

Setting range 1 ... 64

Set with **Rotary control, step keys, numeric keypad --> [ENTER]**
Resolution 1

Default setting 64

5.3.3 TRACE MEMORY



5.3.3.1 TRACE A / B / A&B / A-B

Meaning Measurement curve display

There are two measurement memories:

- The display memory A for the actual measured values

- The background memory B for saving measurement curves or for storing them for reference purposes.

A = Show the measurement curve which corresponds to the actual input signal. While the measurement is taking place (the LED next to the MAN or SWEEP key lights up), the SNA calculates pixels from the actual measured values and the set measurement parameters, and uses them to update the current memory location continuously.

The display memory A can be cleared at any time by pressing the CLEAR TRACE key.

B = Show reference curve(s).

SF2 can be pressed to show the contents of the background memory B, which were saved with the "STORE A -- > B" function, on the display. If the B curves are visible on the display at the same time as a setup is saved, they are transferred to the setup memory as well.

A&B = SF3 can be pressed to show the contents of the background memory B and the display memory A simultaneously. Both the curves are then visible, e.g. for reference measurements. The A curves are made brighter, to distinguish them.

The parameters always apply to the actual measured values.

A-B = Difference between the pixel values of A and B. SF4 can be pressed to show the difference between the contents of the two memories. The pixel difference is calculated and represented on the display as a difference curve or curves. The result is always visible about the zero line. This permits even minute deviations from a setpoint to be evaluated extremely precisely.

Note: The amplitude (difference) is always specified in dB for a spectrum analysis.

Make choice With **[SF1]** = A
[SF2] = B
[SF3]= A&B
[SF4] = A-B

Default setting A

5.3.3.2 A-B ZERO POS MID/TOP; Zero line for A-B representation

Meaning Position of the zero line for an A-B representation.
A-B ZERO POS MID = The zero line is located in the middle of the display.
A-B ZERO POS TOP = The zero line is located at the top of the display.
The position is stored whenever changes are made; it is still active the next time the TRACE A-B function is called up.

Toggle With **[SF5]**

Default setting A-B ZERO POS MID

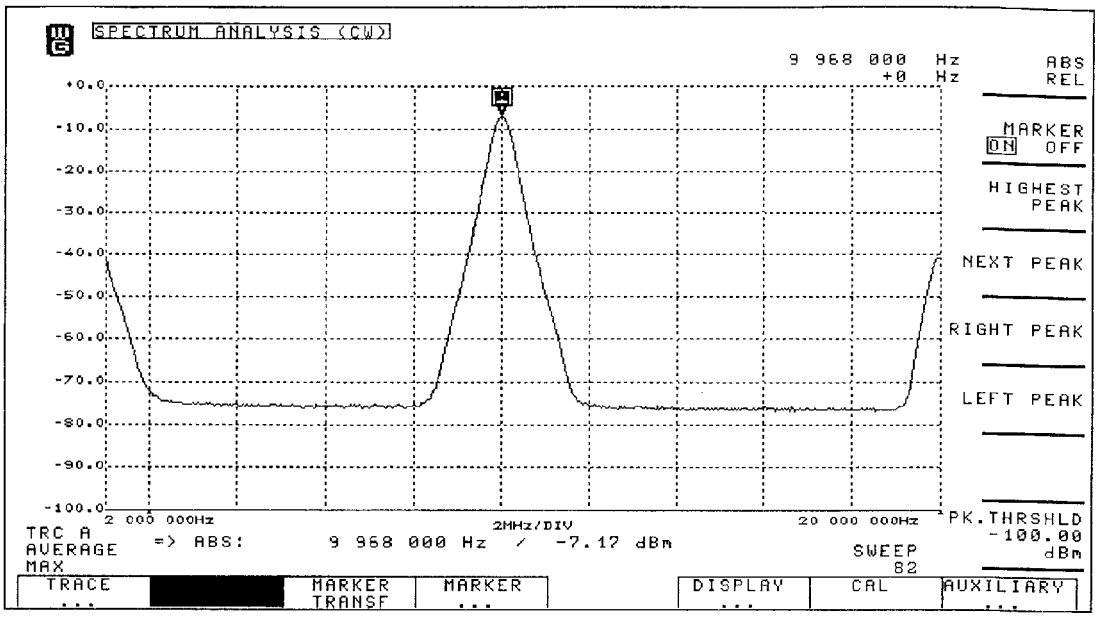
5.3.3.3 STORE A --> B

Meaning Pressing SF7 causes the actual measured values to be copied from the display memory A to the background memory B.

Activate function With **[SF7]**

5.4 MARKER, Evaluating the measurement curve

5.4.1 MARKER PEAK



Using the markers, you can display the values measured by the analyzer. You have access to **ABSolute** and **RELative markers**. The ABS marker indicates the absolute amplitude value measured at the marker frequency. The REL marker shows the amplitude and frequency relative to the ABS marker. A number of auxiliary functions such as HIGHEST PEAK, NEXT PEAK and Marker Transfer make it easy to assess measured values.

5.4.1.1 ABS/REL

Meaning

Switches on the marker and opens display of the current marker frequency or entry of a new marker frequency; the accompanying amplitude value is displayed below the screen graticule.
ABS = Display of the ABS marker.
REL = Display of the REL marker along with the ABS marker.

Note: The marker frequency is displayed above the graticule in the form of a number. If the marker is activated, the last valid position is shown. The last position of the ABS and REL markers may be outside the frequency range currently shown on the display. This is useful, for example, for comparing amplitude peaks with a high resolution.

Entering the ABS marker ensures that at least this marker is displayed. Entering the REL marker causes both markers to be displayed. In this case, pressing the key toggles between them (this is also indicated by the arrow next to the marker display).

Open input

With "**MKR**" key or **[SF1]** ABS/REL

Setting range

Within the currently set frequency limits

Set with

Rotary control, step keys

Resolution FSPAN/1000

Displayed frequency value = frequency at which the displayed measuring point was measured.

Resolution = step width of the synthesizer (approx. (FSPAN/ 4*SWT)*10^{-4})

Numeric keypad --> [ENTER]

Input resolution: 1 Hz

Displayed frequency value = frequency at which the displayed measuring point was measured.

Default setting

ABS 1.569 995 500 GHz

5.4.1.2 MARKER ON/OFF

Meaning

Switches the marker display on/off

ON = At least the ABS marker is activated (automatically when the menu is opened). The REL marker is shown as well if it was active prior to switching off.

OFF = Neither marker is displayed

Toggle

With **[SF2]** ON/OFF

Default setting

OFF

5.4.1.3 HIGHEST PEAK

Meaning

Sets the "active" MARKER to the highest amplitude peak on the displayed curve, providing this peak is higher than the search threshold (PK.THRSHLD).

Activate function

With "**PEAK**" key or **[SF3]**

5.4.1.4 NEXT (lower) PEAK

Meaning

Searches for the next lower amplitude

The active marker jumps to the next lower amplitude peak (in relation to the current value) which is higher than the search threshold (PK.THRSHLD) on the displayed measurement curve.

Set the search threshold beforehand if necessary.

Activate function

With **[SF4]**

5.4.1.5 RIGHT PEAK

Meaning

Searches for the next amplitude peak on the right

The active MKR jumps to the next amplitude peak on the right which is higher than the search threshold (PK.THRSHLD) on the displayed measurement curve.

Start search

With **[SF5]**

5.4.1.6 LEFT PEAK

Meaning

Searches for the next amplitude peak on the left

The active MKR jumps to the next amplitude peak on the left which is higher than the search threshold (PK.THRSHLD) on the displayed measurement curve.

Start search

With **[SF6]**

5.4.1.7 PK.THRSHLD

Meaning

Sets the search threshold

PK.THRSHLD defines the level threshold for the PEAK search functions. The search threshold is represented as a horizontal line in the visible area and can also be used for a numeric evaluation of the measurement curve. The unit of measurement of the level is the same as for REFERENCE (set in DISPLAY .../LEVEL UNITS).

Open input

With **[SF8]** in the "MARKER PEAK" menu

With **[SF8]** in the "MARKER LABEL" menu

Setting range

Corresponds to -150.0 ... +30.0 dBm at the input socket

Set with

Rotary control, step keys

Resolution 1 pixel = scale range/250

Numeric keypad --> [ENTER]

Resolution 0.01 dB

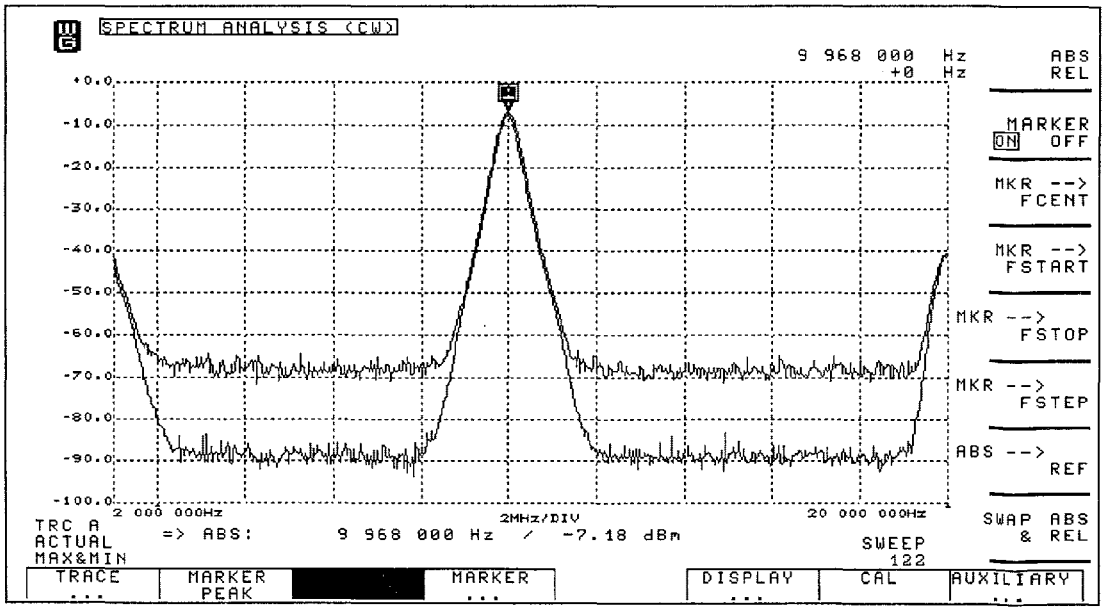
Marker transfer

Resolution 0.01 dB

Default setting

-100.00 dBm

5.4.2 MARKER TRANSFER



5.4.2.1 MKR --> FCENT

Meaning The frequency of the active marker is accepted as FCENT.

Activate function With **[SF3]** or by pressing the FCENT key and holding it down while pressing the MKR key

5.4.2.2 MKR --> FSTART

Meaning The frequency of the active marker is accepted as FSTART.

Activate function With **[SF4]**

5.4.2.3 MKR --> FSTOP

Meaning The frequency of the active marker is accepted as FSTOP.

Activate function With **[SF5]**

5.4.2.4 MKR --> FSTEP

Meaning The frequency of the ABS marker (if MARKER OFF is set) or of the active marker becomes the new frequency step width FSTEP.

Activate function With **[SF6]**

5.4.2.5 ABS --> REFERENCE

Meaning The amplitude of the active marker becomes the new reference.

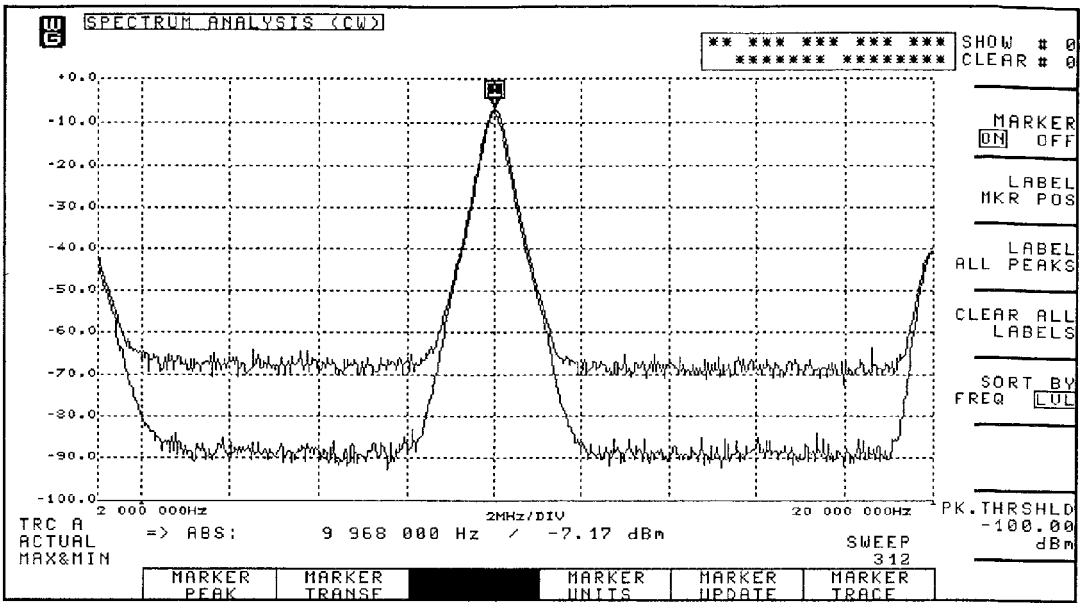
Activate function With **[SF7]** or by pressing the REF key and holding it down while pressing the MKR key.

5.4.2.6 SWAP ABS & REL

Meaning The positions of the ABS and REL markers are swapped.

Activate function With **[SF8]**

5.4.3 MARKER LABEL



5.4.3.1 SHOW #n

Meaning Show MKR LABEL n.
The coordinates (amplitude/frequency) of the label with the number n are shown above the graticule.

Note: Labels are also transferred to the setup memory. If a label has not been set, the "DOES NOT EXIST" error message is output.

Open input With **[SF1]**; toggle with CLEAR #n

Setting range 0 ... 9

Set with **Rotary control, step keys, numeric keypad --> [ENTER]**
Resolution 1

Default setting 0

5.4.3.2 CLEAR #n

Meaning Clear MKR LABEL n.
The label with the specified number is cleared.

Open input With **[SF1]**; toggle with SHOW #n

Setting range 0 ... 9

Set with **Rotary control, step keys, numeric keypad --> [ENTER]**
Resolution 1

Default setting 0

5.4.3.3 LABEL MKR POS

Meaning The position of the active marker is marked with a label.

Activate function With **[SF3]**

5.4.3.4 LABEL ALL PEAKS

Meaning The amplitude peaks on the measurement curve with levels higher than PK.THRSHLD are given free labels. The "SORT BY FREQ/LVL" parameter determines how the labels are allocated:
If SORT BY FREQ is set, the labels are allocated to the level peaks in ascending order, starting with FSTART, with NEXT RIGHT PEAK.
If SORT BY LVL is set, the labels are allocated to the level peaks in descending order, starting with HIGHEST PEAK, with NEXT PEAK.

Set label With **[SF4]**

5.4.3.5 CLEAR ALL LABELS

Meaning All set labels are cleared.

Clear With **[SF5]**

5.4.3.6 SORT BY FREQ/LVL

Meaning The labels are sorted.
FREQ = The labels are assigned in order of increasing frequency. PK.THRSHLD must be higher than the intrinsic noise.
LVL = The labels are assigned in order of decreasing amplitude. PK.THRSHLD must be lower than the highest peak.
The sorting scheme must be selecting prior to assigning the labels.

Toggle With **[SF6]** FREQ/LVL

Default setting LVL (Reason: LVL produces meaningful results in conjunction with the default setting of PK.THRSHLD).

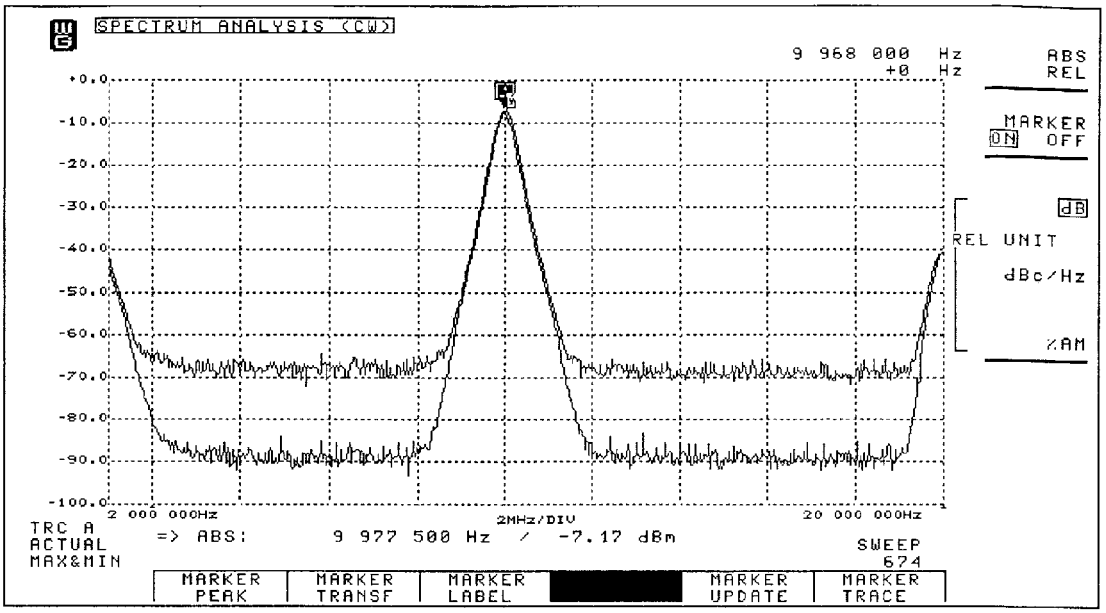
5.4.3.7 DISPLAY GRAPH/LIST

Meaning Specify the display of the labels.
GRAPH = The labels are shown alongside of the corresponding screen points on the measurement trace as boxed-in numbers.
LIST = The labels are listed in numerical order with their coordinates (frequency/level). The measurement trace now longer appears.
The sorting scheme must be selecting prior to assigning the labels.

Toggle With **[SF7] GRAPH/LIST**

Default setting GRAPH

5.4.4 MARKER UNITS



5.4.4.1 REL UNIT dB / dB (NOISE) / dBc/Hz /%AM

Meaning

Unit of measurement of the REL marker

The representation of the REL marker can be matched to the application:

dB = Amplitude difference between the ABS and REL markers.

dB (NOISE) = The noise weighting compensation value of 2 dB is added automatically.

The user must have set the ABS marker to a spectral line and the REL marker to noise.

dBc/Hz = The level difference is converted to a bandwidth of 1 Hz

(Value in dBc/Hz = value in dB - 10*log (RBW/1 Hz) + compensation value (for noise weighting by the rectifier).

The user must have set the ABS marker to a spectral line and the REL marker to noise.

%AM = The level difference is specified directly as a modulation depth for AM.

(Value in %AM = $2*10^{\text{value in dB}/20}$). 100% corresponds to two side lines of equal magnitude, which are arranged symmetrically on either side of the carrier and at a distance of 6 dB from it.

The user must have set the ABS marker to the carrier of an amplitude-modulated signal and the REL marker to a modulation-dependent spectral line.

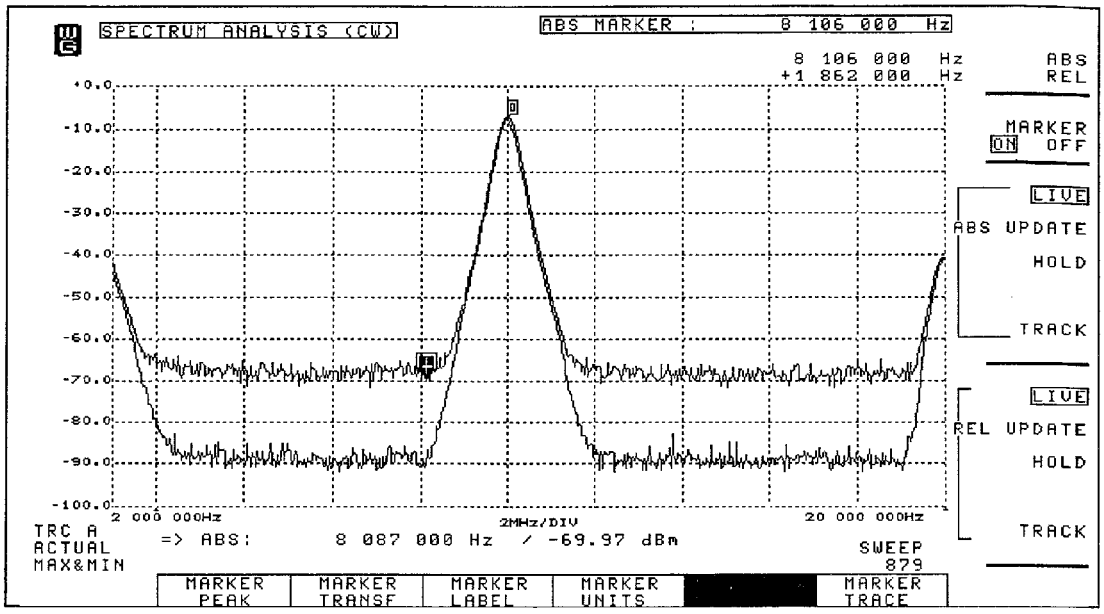
Make choice

With **[SF3]** dB
[SF4] dB (NOISE)
[SF5] dBc/Hz
[SF6] %AM

Default setting

dB

5.4.5 MARKER UPDATE



5.4.5.1 ABS UPDATE LIVE/HOLD / TRACK

Meaning

Updates the ABS marker

LIVE = Every measurement at the marker frequency updates the marker level; the marker frequency is retained.

HOLD = The last level of the ABS marker to have been evaluated at the time of the changeover to HOLD is saved and made available as a reference value; it does not change subsequently, even if a new measurement is taken at the marker frequency.

If a new frequency is entered for the ABS marker in this state or the PEAK key is pressed, the marker is set to this frequency and the level which is evaluated at this time and at this frequency is accepted.

TRACK = The marker initially behaves in the same way as with HOLD. At the end of a sweep, however, the system checks whether the marker is positioned on a peak. If not, it is set to the nearest peak.

If a marker is not visible, HOLD/LIVE/TRACK is considered to be a preset. The marker will thus follow a drifting measurement line.

Make choice

With **[SF3]** LIVE
[SF4] HOLD
[SF5] TRACK

Default setting

LIVE

5.4.6 REL UPDATE LIVE/HOLD/TRACK

Meaning

Updates the REL marker

LIVE = Every measurement at the ABS marker frequency or at the REL marker frequency updates the marker display.

HOLD = The REL marker remains at the same absolute position (frequency, level), and is made available as a reference value, even if a new measurement has been taken in the meantime at the REL marker frequency.

The marker display changes if the ABS marker display changes.

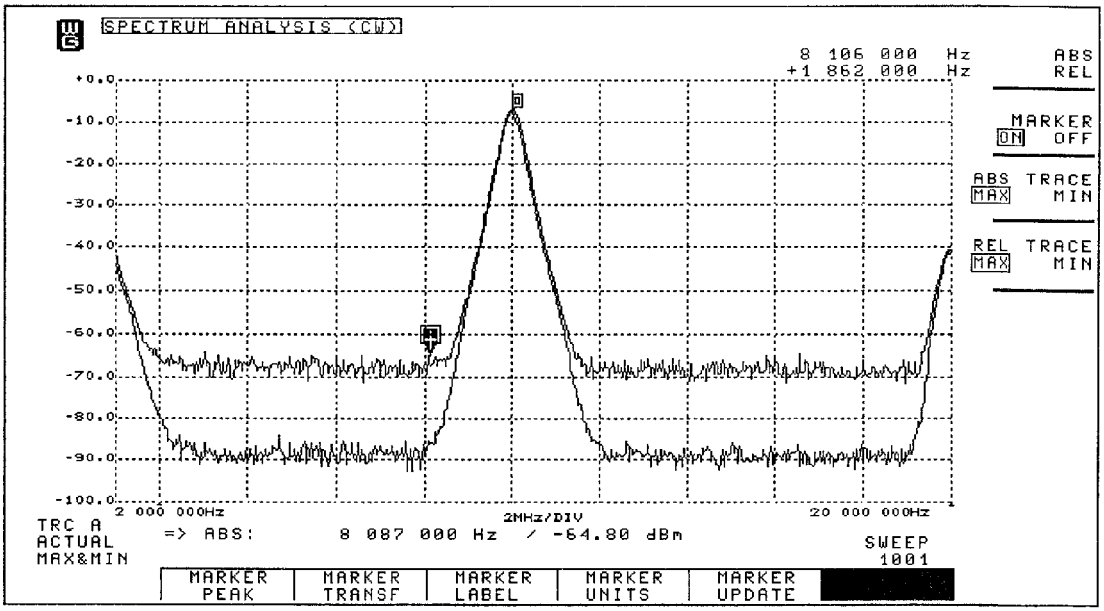
TRACK = The marker initially behaves in the same way as with HOLD. At the end of a sweep, however, the system checks whether the marker is positioned on a peak. If not, it is set to the nearest peak.

If a marker is not visible, HOLD/LIVE/TRACK is considered to be a preset.

Make choice With **[SF6]** LIVE
[SF7] HOLD
[SF8] TRACK

Default setting LIVE

5.4.7 MARKER TRACE



5.4.7.1 ABS TRACE MAX/MIN

Meaning Defines the measurement curve which is evaluated by the ABS marker

MAX = The marker evaluates the MAX measurement curve, even if it is not visible.

MIN (SAMPLE) = The marker evaluates the MIN or SAMPLE measurement curve, even if it is not visible.

If a marker is not visible, MAX/MIN is considered to be a preset.

Toggle With **[SF3]** MAX/MIN (SAMPLE)

Default setting MAX

5.4.7.2 REL TRACE MAX/MIN

Meaning

Defines the measurement curve which is evaluated by the REL marker

MAX = The marker evaluates the MAX measurement curve, even if it is not visible.

MIN (SAMPLE) = The marker evaluates the MIN or SAMPLE measurement curve, even if it is not visible.

If a marker is not visible, MAX/MIN is considered to be a preset.

Toggle

With **[SF4]** MAX/MIN (SAMPLE)

Default setting

MAX

5.5 DISPLAY, Defining the displays

5.5.1 User title

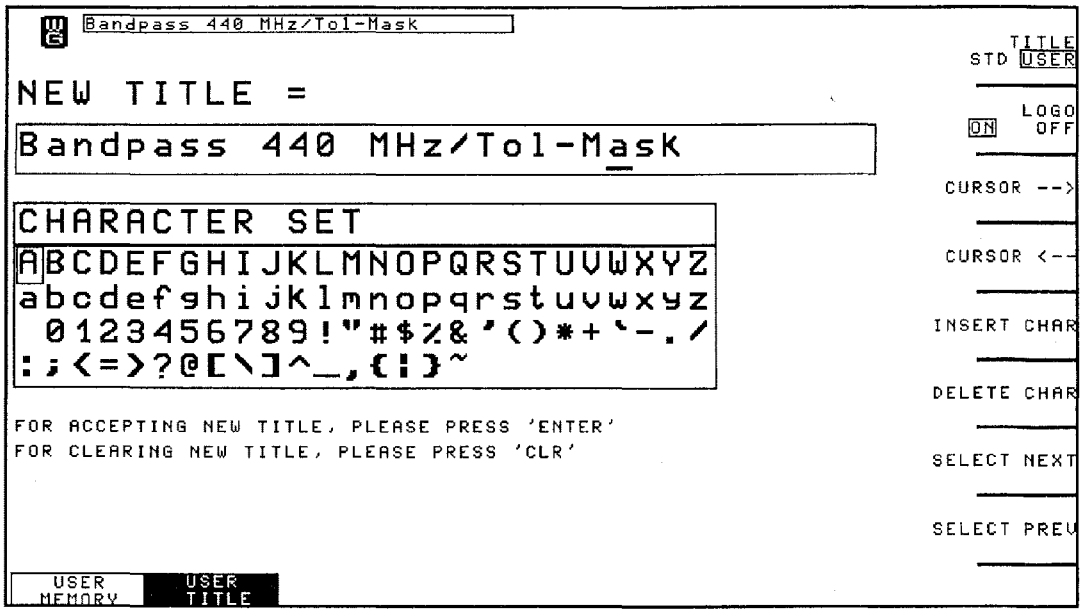


Fig. 5-5 Access the USER TITLE menu in the Display... submenu and the USER MEM menu.

In this menu, you can create your own titles for documenting measuring screens or for your own instrument setups. You can print or plot these titles and store them in the setup memory if they are currently displayed.

When you call up the menu, the current USER TITLE or the mode is entered into the NEW TITLE = field.

The easiest way to enter or edit titles is by connecting an external AT keyboard to the "EXT. KEYBOARD" jack. The character set is indicated in the CHARACTER SET field.
Using the instrument keypad, you can:

- Press the CLR key to delete the entire USER TITLE at once;
- Use the digit keys and the G, M and k keys to directly enter the printed character in the NEW TITLE = field;

– Use the ENTER key to accept the NEW TITLE = field as the new USER TITLE. However, it is not displayed until TITLE USER is selected with [SF1].

The remaining characters can be selected from the CHARACTER SET field using the step keys, the rotary control or the softkeys [SF7] SELECT NEXT or [SF8] SELECT PREVIOUS. Press [SF5] INSERT CHARACTER to insert them at the current cursor position.

Calling up the menu from the main menu

- Press **[F6]** DISPLAY ... to call up the submenu.
- Press **[F1]** USER TITLE to call up the submenu for creating individual screen titles.

Or:

- Press the **USER MEM** key to call up the submenu.
- Press **[F2]** USER TITLE to call up the submenu for creating individual screen titles.

5.5.1.1 TITLE STD/USER

Meaning

Selection of the screen title.

STD = Title displays the SPECTRUM ANALYSIS mode.

USER = User title which was entered and then accepted with the ENTER key. The USER TITLE is also indicated in the setup memory once it has been accepted and displayed with TITLE USER.

Toggle

In the User Title menu with [SF1]

5.5.1.2 LOGO ON/OFF

Meaning

Display of the W&G logo on the screen or hardcopy.

LOGO ON = Logo visible on the screen and hardcopy.

LOGO OFF = Logo omitted from the screen and hardcopy.

Toggle

In the User Title menu with **[SF2]**

5.5.1.3 Cursor -->

Bedeutung

Shift the cursor one position to the right in the NEW TITLE = field.

Each time you press this key, the cursor, which indicates where a character is to be inserted or deleted, is shifted by one position to the right.

Activate function

In the User Title menu with **[SF3]**

5.5.1.4 Cursor <--

Meaning

Shift the cursor one position to the left in the NEW TITLE = field.

Each time you press this key, the cursor, which indicates where a character is to be inserted or deleted, is shifted by one position to the left.

Activate function

In the User Title menu with **[SF4]**

5.5.1.5 INSERT CHAR

Meaning

The character selected in the CHARACTER SET field is inserted at the point indicated by the cursor in the NEW TITLE = field. The selected character is indicated by a box in the CHARACTER SET field. Shift the box:

- **Horizontally** with the rotary control or [SF7] SELECT NEXT or [SF8] SELECT PREV;
- **Vertically** with the step keys.

Attention: If another window is opened after you open this menu (e.g. with a direct access key), the rotary control must be reactivated by pressing a key used in the User Title menu.

Activate function

In the User Title menu with **[SF5]**

5.5.1.6 DELETE CHAR

Meaning

The character over the cursor in the NEW TITLE = field is deleted.

Delete

In the User Title menu with **[SF6]**

5.5.1.7 SELECT NEXT

Meaning

Selection of a character in the NEW TITLE = field. For each keystroke, the box moves one position to the right. When it reaches the end of a line, the box jumps to the first character in the next line.

Activate function

In the User Title menu with **[SF7]**

5.5.1.8 SELECT PREV

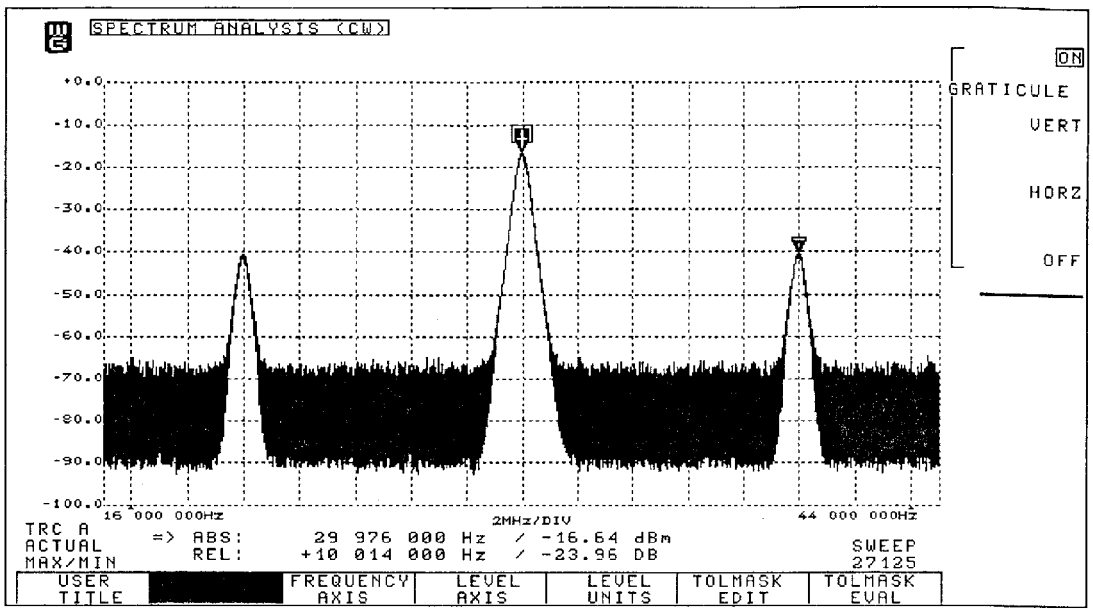
Meaning

Selection of a character in the NEW TITLE = field. For each keystroke, the box moves one position to the left. When it reaches the start of a line, the box jumps to the last character in the previous line.

Activate function

In the User Title menu with **[SF8]**

5.5.2 GRATICULE ON / VERT / HORZ / OFF



Meaning

Graticule display

The graticule is automatically matched to the set ranges; the lines are set to "rounded" values.

- Frequency scale (vertical graticule lines): A graticule is determined according to the representation of the frequency range (START/STOP, START/SPAN or CENT/SPAN) and the set frequency span or linear/logarithmic representation; the vertical lines always correspond to smooth frequency values. This scale division is indicated underneath the graticule (Hz/DIV, kHz/DIV, MHz/DIV, GHz/DIV). This means that every measured value can be attributed to the measurement frequency easily, without having to interpolate it. A numeric value is also displayed at the start and end of the frequency scale. It marks the graticule line which is also indicated by an arrow. This may be FSTART, FSTOP or FCENT or - if the frequency values are not linear - the next graticule lines inwards.

- Level scale (horizontal graticule lines): Dependent on whether absolute or relative level scaling is set, as well as a linear or logarithmic representation and the level unit.

GRATICULE ON = All the vertical and horizontal graticule lines are displayed.

GRATICULE VERT = All the vertical graticule lines and the top and bottom horizontal lines are displayed.

GRATICULE HORZ = All the horizontal graticule lines and the leftmost and rightmost vertical lines are displayed.

GRATICULE OFF = Only the boundary lines of the graticule, i.e. the top and bottom horizontal lines and the leftmost and rightmost vertical lines are displayed.

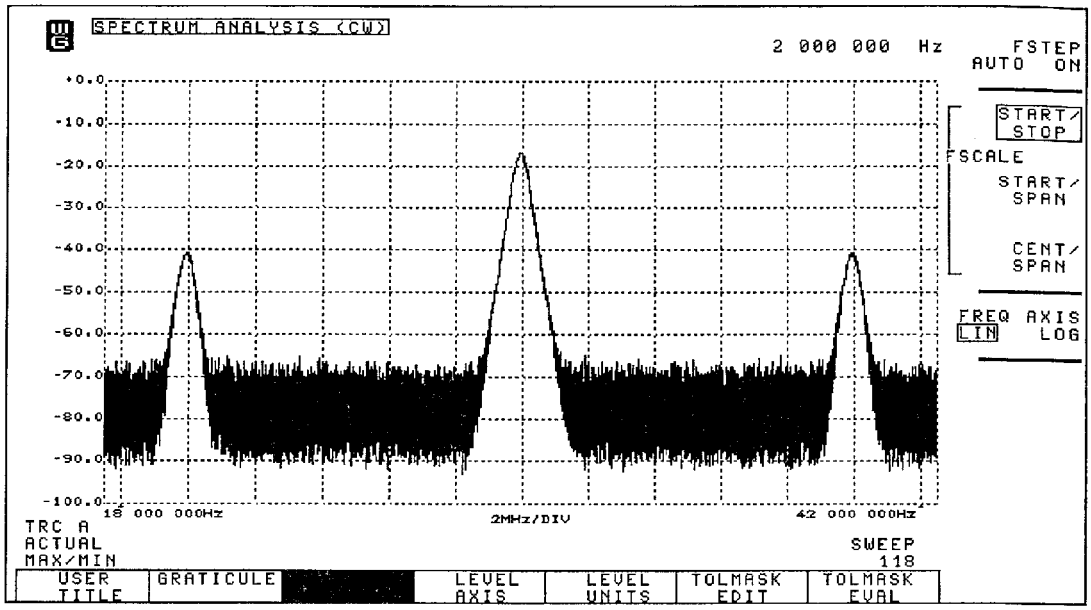
Make choice

With **[SF1]** = ON
[SF2] = VERT
[SF3] = HORZ
[SF4] = OFF

Default setting

GRATICULE ON

5.5.3 FREQUENCY AXIS, Frequency axis display



5.5.3.1 FSTEP

Meaning

Frequency step width

The step width set with this function is active if frequency parameters (FSTART, FSPAN, etc.) are altered with the STEP keys. If AUTO ON is set and a linear frequency axis has been selected, FSTEP has the same magnitude as the scale division xHz/DIV. If AUTO ON and a logarithmic frequency axis have been set, FSTEP = FSTART.

Note: The FSTEP function is extremely useful, for example for analyzing signal distortion. The frequency span may be so small that only the fundamental oscillation is visible on the display.

- Set the marker to the peak of the fundamental wave with the "PEAK" key.
- Press **[F3]**, "MARKER TRANSFER" to open the submenu.
- Press **[SF6]**, "MKR --> FSTEP" to accept the frequency of the fundamental oscillation as the new frequency step width.
- Press the "FCENT" key to open the center frequency input.
- Press the STEP ⇑ key. The center frequency is adjusted so that the 1st harmonic is visible on the display.
- Press the STEP ⇑ key. The center frequency is adjusted so that the 2nd harmonic is visible on the display.

Open input

With **[SF1]**

Setting range

SNA-20	0 to 3.2 GHz
SNA-23	0 to 30.0 GHz

Set with

AUTO key
Automatically coupled with FSPAN (ON/OFF)
AUTO OFF if FSTEP altered using:
Rotary control, step keys, numeric keypad --> [ENTER]
Resolution 1 Hz
Marker transfer

Default setting

500 MHz, AUTO ON

5.5.3.2 FSCALE START/STOP, CENT/SPAN, START/SPAN

Meaning

Frequency axis scaling

START/STOP = The measuring range is defined by means of the start and stop frequencies and the labels on the frequency axis are absolute.

CENT/SPAN = The measuring range is defined by means of the center frequency and the sweep span.

Linear frequency axis: labeling relative to the center frequency

Logarithmic frequency axis: labeling absolute

START/SPAN = The measuring range is defined by means of the start frequency and the frequency span.

Linear frequency axis: labeling relative to the start frequency

Logarithmic frequency axis: labeling absolute

The frequency limits are entered with these parameters in the main menu and the graticule is adapted accordingly.

Note: It is advisable to set START/STOP, as FCENT and FSPAN are directly accessible via "DIRECT SETTING".

Make choice

With **[SF2]** = START/STOP
[SF3] = CENT/SPAN
[SF4] = START/SPAN

Default setting

FSCALE START/STOP

5.5.3.3 FREQ AXIS LIN/LOG

Meaning

The frequency axis is represented with a linear or logarithmic scale. The graticule and the labeling on it are adapted accordingly.

FREQ AXIS LIN = The measured values are calculated and displayed in frequency steps on a linear scale.

FREQ AXIS LOG = The measured values are displayed on a logarithmic scale. The frequency sweep is however proportional to the time (optimum measurement time). The sweep time is slightly longer than SWT for technical reasons.

Toggle

With **[SF5]** LIN/LOG

Default setting

FREQ AXIS LIN

5.5.4 LEVEL AXIS, Representation of amplitude axis

5.5.4.1 LSTEP

Meaning

Level step width

The step width set with this function is active if level parameters (e.g. REFERENCE, PK.THRSHLD) are altered with the STEP keys. If AUTO ON is set, LSTEP has the same magnitude as one scale division. LSTEP is always specified in dB, even if the LEVEL UNIT is V or W.

Open input

With **[SF1]**

Setting range

0 ... +100.0 dB

Set with

AUTO key

Automatically coupled with SCALE ON/OFF

AUTO OFF if LSTEP altered using:

- Rotary control, step keys

Resolution 1 dB

- Numeric keypad --> [ENTER]

Resolution 0.01 dB

Default setting

10 dB, AUTO ON

5.5.4.2 SCALE LIN/LOG

Meaning

The input signal is measured on a linear or logarithmic scale. The graticule and the labeling on it are adapted accordingly. The level unit remains unchanged.

MEAS SCALE LIN = The measured values are recorded and displayed proportionally to the voltage.

MEAS SCALE LOG = The measured values are recorded and displayed proportionally to the level.

Toggle

With **[SF2]** LIN/LOG

Default setting

MEAS SCALE LOG

5.5.4.3 SCALE ABS/REL

Meaning

The level axis is labeled either with absolute values or relative to the REFERENCE value.

SCALE ABS = The scale labeling is absolute.

SCALE REL = The scale labeling is relative to the REFERENCE level. The absolute level of the spectral lines which are shown is derived from the sum of the Y scale value and the REFERENCE value.

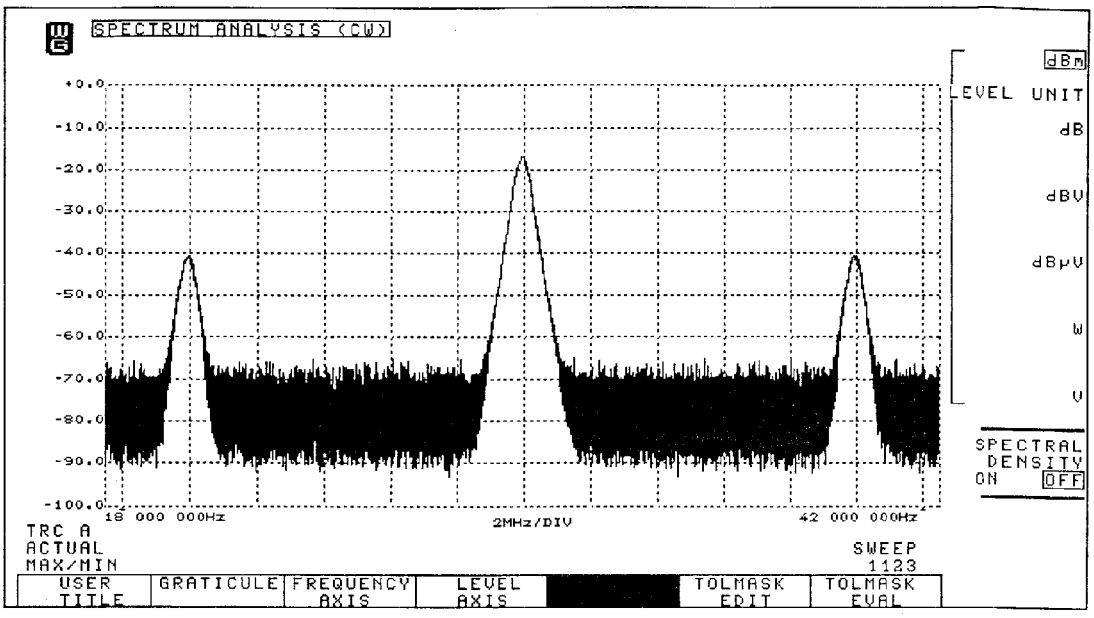
Toggle

With **[SF3]** ABS/REL

Default setting

SCALE REL

5.5.5 LEVEL UNITS



5.5.5.1 LEVEL UNIT

Meaning

Level unit

This function determines the unit of measurement which is to be used to calculate the pixels corresponding to the measured values and to represent them as measurement curves. The graticule is adapted accordingly. All levels are calculated internally in dB.

dB =	Reference 0 dB = 0.7745966 V (= 1 mW/600 Ω)
dBm =	Reference = 1 mW
dBV =	Reference = 1 V
dBµV =	Reference = 1 µV
W =	Reference = watts (power)
V =	Reference = volts (voltage)

If the SPECTRAL DENSITY parameter is set to ON, the measured values are referred to 1 Hz; either "/Hz" or "/√Hz" is added to the unit.

dBm/Hz =	dBm/Hz_level = dBm_level - 10*log(RBW/1 Hz)
dB/√Hz =	dB/√Hz_level = dB_level - 10*log(RBW/1 Hz)
dBV/√Hz =	dBV/√Hz_level = dBV_level - 10*log(RBW/1 Hz)
dBµV/ √Hz =	dBµV/√Hz_level = dBµV_level - 10*log (RBW/1 Hz)
W/Hz =	power/Hz = power/(RBW/1 Hz)
V/√Hz =	volts/√Hz_voltage = volts_voltage/(RBW/1 Hz)

Make choice

With **[SF1]** dBm or dBm/Hz
[SF2] dB or dB/√Hz
[SF3] dBV or dBV/√Hz
[SF4] dBµV or dBµV/√Hz
[SF5] W or W/Hz
[SF6] V or V/√Hz

Default setting

LEVEL UNIT dBm

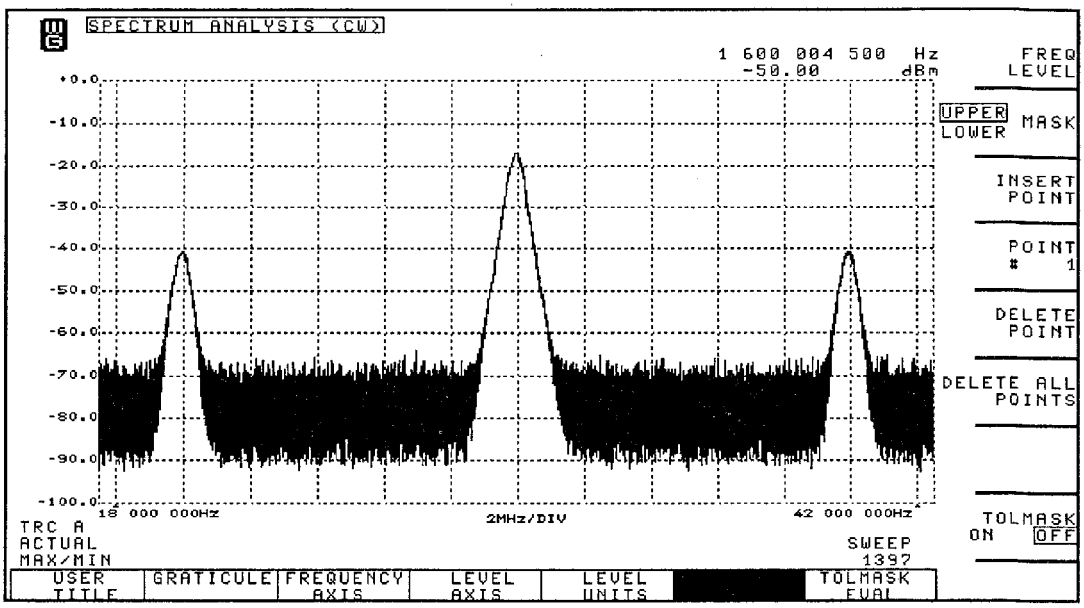
5.5.5.2 SPECTRAL DENSITY ON/OFF

Meaning If SPECTRAL DENSITY is set to ON, the measured values are referred to the 1 Hz bandwidth and the measurement curve is converted accordingly. The MARKERs show the results in the appropriate LEVEL UNIT. The conversion is based on the assumption that the power is evenly distributed within the RBW.

Toggle With **[SF7]** ON/OFF

Default setting OFF

5.5.6 TOLMASK EDIT, Edit tolerance masks



5.5.6.1 FREQUENCY

Meaning Tolerance mask point frequency

Frequency of the actual tolerance mask point POINT #n. The corresponding point is marked graphically if GRAPH is selected as the type of representation. If this point does not exist, the word "INVALID" appears instead of a frequency.

Open input With **[SF1]**; toggle with LEVEL

Setting range FSTART ... FSTOP

Set with **Rotary control**
Resolution FSPAN/500
Step keys
Resolution FSPAN/500
Numeric keypad --> [ENTER]
Resolution 1 Hz

Default setting Frequency of the POINT # mask point

5.5.6.2 LEVEL

Meaning Tolerance mask point level

Open input With **[SF1]**; toggle with FREQUENCY

Setting range -150.0 ... +30.0 dB

Set with
Rotary control
Resolution 1 pixel = scale range/250
Step keys
Resolution 1 pixel = scale range/250
Numeric keypad --> [ENTER]
Resolution 0.01 dB

Default setting LSTEP

5.5.6.3 MASK UPPER/LOWER

Meaning Determines the tolerance limit which is to be edited
EDIT MASK UPPER = The upper tolerance limit is selected.
EDIT MASK LOWER = The lower tolerance limit is selected.

Toggle With **[SF2]** UPPER/LOWER

Default setting UPPER

5.5.6.4 INSERT POINT

Meaning Add or insert a tolerance mask point.
The point is defined with SF1 "FREQ/LEVEL". SF2 "MASK UPPER/LOWER" assigns this point to either the upper or the lower tolerance limit. SF4 "POINT # n" determines where the point is to be added or inserted.
The point is accepted with INSERT POINT.

Activate function With **[SF3]**

5.5.6.5 POINT #3

Meaning Selects the actual tolerance mask point
A tolerance mask point is selected, in order to enter, modify or delete its position. The last mask point to have been selected is displayed when the menu is opened.

Open input With **[SF4]**

Setting range 1 ... 10

Set with **Rotary control, step keys, numeric keypad --> [ENTER]**
Resolution 1

Default setting 1

5.5.6.6 DELETE POINT

Meaning Deletes a tolerance mask point
This parameter deletes the point which has been selected with POINT # n and MASK UPPER/LOWER.

Delete With **[SF5]**

5.5.6.7 DELETE ALL POINTS

Meaning Deletes all the tolerance mask points
This parameter deletes all the points at the current tolerance limit selected with MASK UPPER/LOWER.

Delete With **[SF6]**

5.5.6.8 DISPLAY GRAPH/LIST

Meaning Specify the display of the labels.
GRAPH = The labels are shown alongside of the corresponding screen points on the measurement trace as boxed-in numbers.
LIST = The labels are listed in numerical order with their coordinates (frequency/level). The measurement trace now longer appears.
The sorting scheme must be selecting prior to assigning the labels.

Toggle With **[SF7] GRAPH/LIST**

5.5.6.9 TOLMASK ON/OFF

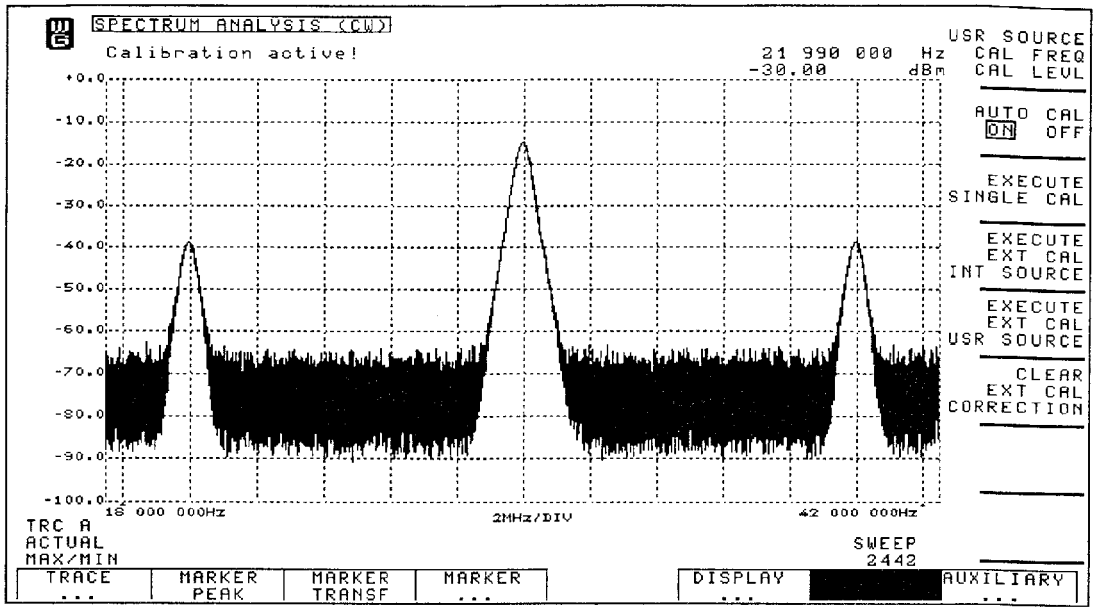
Meaning Switches the tolerance mask display on and off. If the tolerance mask is ON, it is transferred to the setup memory.

Toggle With **[SF8]** ON/OFF

Default setting OFF

Note: Programming of a tolerance mask
(see 4.3.1.3 on page 4-17)

5.6 CAL, Defining calibration (adjustment)



5.6.1 USR SOURCE CAL FREQ/CAL LEVL

Meaning
This function specifies the frequency and level of a user source which is used for external calibration purposes.

Open input
CAL FREQ
With **[SF1]**; toggle between CAL FREQ and CAL LEVL

Setting range

SNA-20	0 ... 3.2 GHz
SNA-23	0 ... 30 GHz

Set with
Rotary control
Resolution FSTEP
Step keys
Resolution FSTEP
Numeric keypad --> [ENTER]
Resolution 1 Hz

Default setting
CAL LEVL
21.990 000 MHz

Setting range
-30.00 ... +30.00 dBm

Set with
Rotary control
Resolution LSTEP
Step keys
Resolution LSTEP
Numeric keypad --> [ENTER]
Resolution 0.01 dB

Default setting
-30.00 dBm

5.6.2 AUTO CAL ON/OFF

Meaning

Switches the automatic calibration function after the IF on and off.

AUTO CAL ON = Calibrated:

- If the resolution bandwidth RBW is changed
- Roughly every 10 minutes
- If necessary, after the video bandwidth is changed

AUTO CAL OFF = The instrument is only calibrated on request, i.e. EXECUTE SINGLE CAL, EXECUTE EXT CAL INT SOURCE, EXECUTE EXT CAL USR SOURCE or AUTO CAL ON.

Toggle

With **[SF2]**

Default setting

AUTO CAL ON

5.6.3 EXECUTE SINGLE CAL

Meaning

Single calibration of the level deviation after the IF

Pressing **[SF3]** starts a single calibration procedure. The setting of "AUTO CAL" is irrelevant.

Activate function

With **[SF3]**

5.6.4 EXECUTE EXT CAL INT SOURCE

Meaning

External calibration of the level deviation from the input socket to the IF-internal source

Pressing **[SF4]** starts an absolute level calibration procedure for the SNA at 21.99 MHz. The calibration signal (-30 dBm/50 Ω) is made available at the "CAL OUT" output [11] for the duration of this procedure. The necessary user actions are prompted on the display. The setting of "AUTO CAL" is irrelevant. The setting of EXTERN ATTN/EXT Z in the main menu is ignored. The EXT CAL is followed immediately by a SINGLE CAL.

Activate function

With **[SF4]**

5.6.5 EXECUTE EXT CAL USR SOURCE

Meaning

External calibration of the level deviation from the input socket to the IF-external USR SOURCE.

Pressing **[SF5]** starts an absolute level calibration procedure for the SNA. The calibration signal is made available by the user; its frequency and level must correspond to the CAL FREQ and CAL LEVL parameters. The setting of EXTERN ATTN/EXT Z in the main menu is taken into account. The EXT CAL is followed immediately by a SINGLE CAL.

Activate function

With **[SF5]**

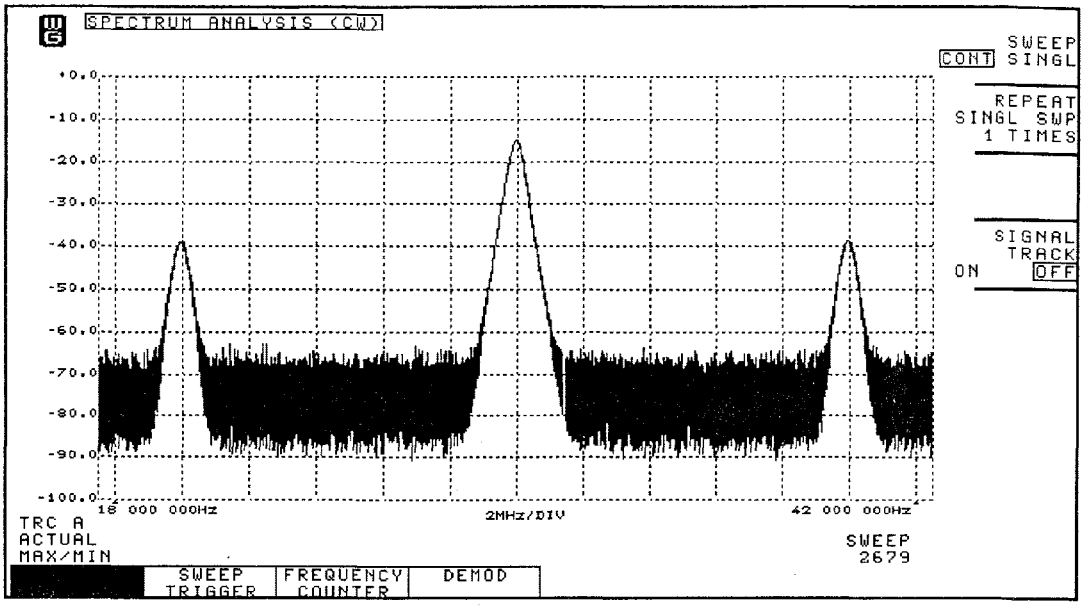
5.6.6 CLEAR EXT CAL CORRECTION

Meaning Sets the external calibration correction value to 0

Clear With **[SF6]**

5.7 SWEEP MODE, Sweep conditions

5.7.1 SWEEP MODE



5.7.1.1 SWEEP CONT

Meaning Continuous or single sweep

SWEEP CONT = The sweep is repeated cyclically. The number of valid and complete sweeps is indicated by the cycle counter. The setting of SF2, REPEAT SINGL SWP n TIMES is irrelevant when SWEEP CONT is set.

SWEEP SINGL = After the sweep is started by pressing the /SWEEP/ key, the frequency range is swept the number of times preset with SF2. The SNA is then set to "HOLD".

Toggle With **[SF1]**

Default setting SWEEP CONT

5.7.1.2 REPEAT SINGL SWP n TIMES

Meaning Number of single sweeps

The number of sweeps activated by SWEEP SINGL can be entered here. A high number is advisable, for example, if the averaging function AVRG or MAX/MIN HOLD is active.

Open input With **[SF2]**

Setting range 1 ... 255

Set with **Rotary control, step keys, numeric keypad --> [ENTER]**
Resolution 1

Default setting 1

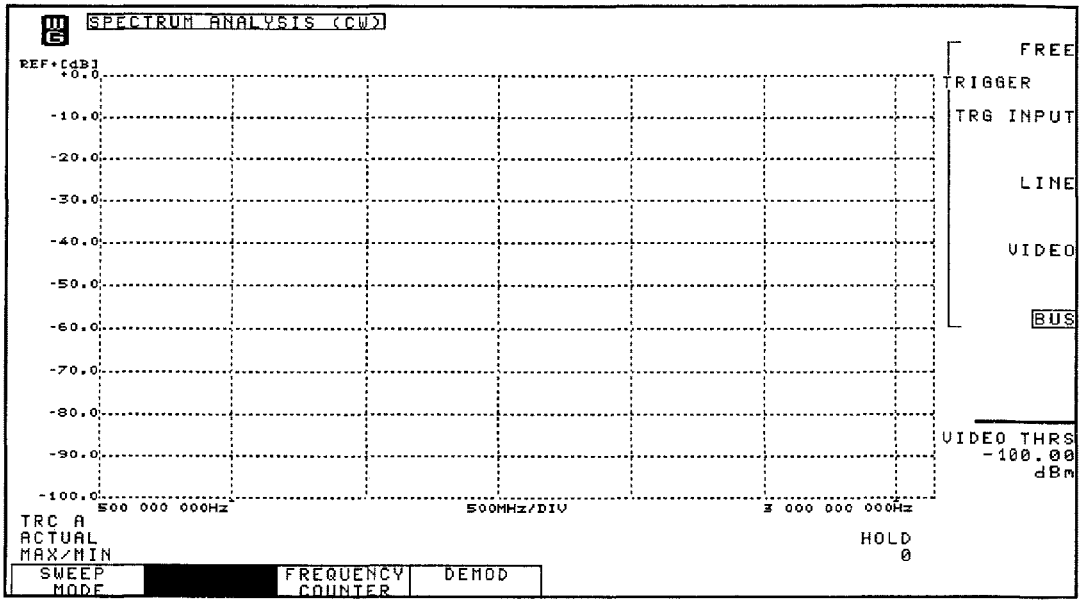
5.7.1.3 SIGNAL TRACK ON/OFF

Meaning Holds the spectral line in the center of the display
SIGNAL TRACK adjusts the center frequency automatically after every sweep, so that the spectral line which is closest to FCENT is moved to the center of the display.

Toggle With **[SF3]**

Default setting OFF

5.7.2 SWEEP TRIGGER



5.7.2.1 TRIGGER FREE / TRG INPUT / LINE / VIDEO

Meaning Triggers a sweep
This function determines how the sweep is triggered.

FREE = When one sweep has finished, the next sweep starts immediately, providing the number preset with SWEEP SINGL has not yet been reached. The sweep starts as soon as the instrument is set to FSTART and RBW and VBW have settled at the FSTART level.

TRG INPUT = A positive edge at the INPUT TRIGGER socket [56] starts the sweep as soon as the FREE condition is satisfied. The instrument can thus be synchronized with other instruments.

LINE = A positive edge supplied by the internal, line-synchronous trigger circuit starts the sweep as soon as the FREE condition is satisfied. This permits a.c. line interference on the display to be suppressed.

VIDEO = The sweep starts as soon as the FREE condition is satisfied and the measurement amplitude of TRACE A exceeds the threshold set for the VIDEO THRS parameter.

BUS = As soon as the condition for FREE is met, the IEEE bus command "TRIGGER [GET]" starts the sweep. The instrument is in remote control mode thereafter. If this is not desired, the command "GO TO LOCAL [GTL]" must be inserted after the trigger.
It is possible in this manner to synchronize an SNA with remote-controlled instruments during manual operation.

Make choice

With **[SF1]** = FREE
[SF2] = TRG INPUT
[SF3] = LINE
[SF4] = VIDEO
[SF5] = BUS

Default setting

FREE

5.7.2.2 VIDEO THRS

Meaning

Sets the trigger threshold

VIDEO THRS defines the level threshold for the "VIDEO" function. The search threshold is represented as a horizontal line in the visible area and can also be used for numerical evaluations of the measurement curve. The unit of measurement of the level is matched to
REFERENCE.

Open input

With **[SF7]**

Setting range

-150.00 ... +30.00 dBm, level uncertainty approx. 1 dB

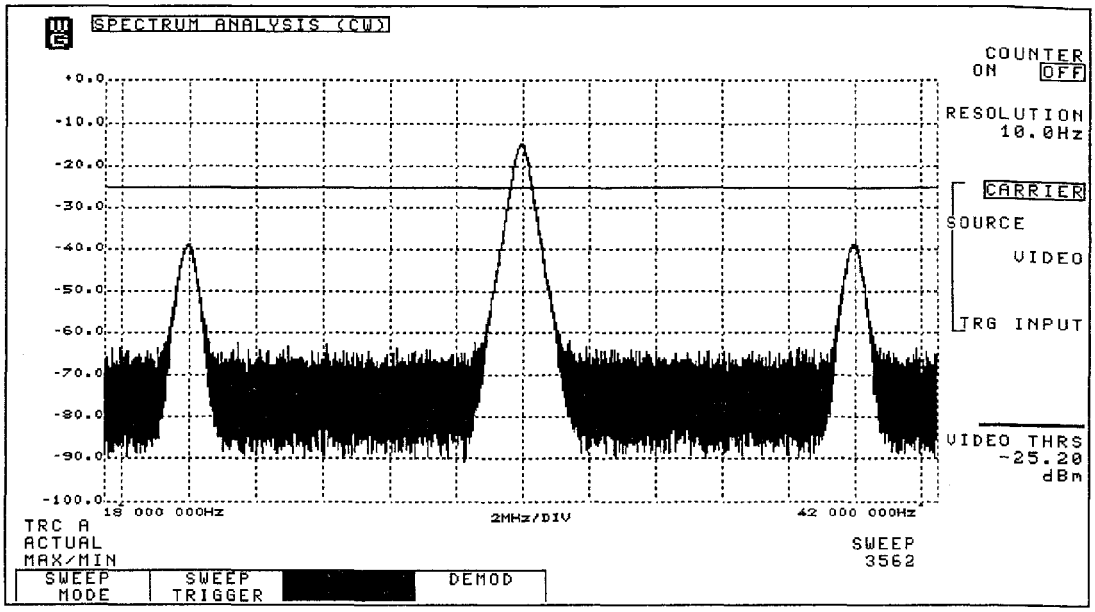
Set with

Rotary control, step keys
Resolution 1 pixel = scale range/250
Numeric keypad --> [ENTER]
Resolution 0.01 dB

Default setting

-100.00 dBm

5.7.3 FREQUENCY COUNTER



5.7.3.1 COUNTER ON/OFF

Meaning Switches the frequency counter on and off. If the frequency counter is switched on, the instrument is tuned to the ABS marker frequency when FSTOP is reached and the frequency is measured. The result is visible in a box outside the graticule.

Toggle With **[SF1]** ON/OFF

Default setting OFF

5.7.3.2 RESOLUTION

Meaning Resolution of the frequency counter

It is possible to set the resolution of the frequency counter. The measurement period is dependent on the resolution.

Open input With **[SF2]**

Setting range

Resolution	100 Hz	10 Hz	1 Hz	0.1 Hz
Measurement period	10 ms	100 ms	1 s	10 s

Set with **Rotary control, step keys, numeric keypad --> [ENTER]**

Resolution 1 step, though setting still possible with 0.1 Hz resolution

Default setting 10.0 Hz

5.7.3.3 SOURCE CARRIER / VIDEO / TRG INPUT

Meaning

Signal source of the frequency counter

This function determines which signal is evaluated by the frequency counter.

CARRIER = The frequency of the IF signal is counted. The sum of the counter result and the tuning frequency is displayed. The result thus corresponds to the frequency of the input signal.

VIDEO = The rectified measurement signal is compared with the level threshold VIDEO THRS. The number of times the threshold is exceeded per selected time period is counted and displayed. The pulse repetition frequency of a pulsed signal can be measured in this way, for example.

TRG INPUT = The signal present at the "INPUT TRIGGER" socket [56] is evaluated. The number of positive edges per selected time period is counted. The maximum frequency is approximately 25 MHz.

Make choice

With **[SF3]** = CARRIER
[SF4] = VIDEO
[SF5] = TRG INPUT

Default setting

CARRIER

5.7.3.4 VIDEO THRS

Meaning

Sets the counting threshold for SOURCE VIDEO

VIDEO THRS defines the level threshold for the TRIGGER VIDEO function. The counting threshold is represented as a horizontal line in the visible area. The unit of measurement of the level is matched to REFERENCE.

Open input

With **[SF7]**

Setting range

-150.00 ... +30.00 dBm, level uncertainty approx. 1 dB

Set with

Rotary control, step keys

Resolution 1 pixel = scale range/250

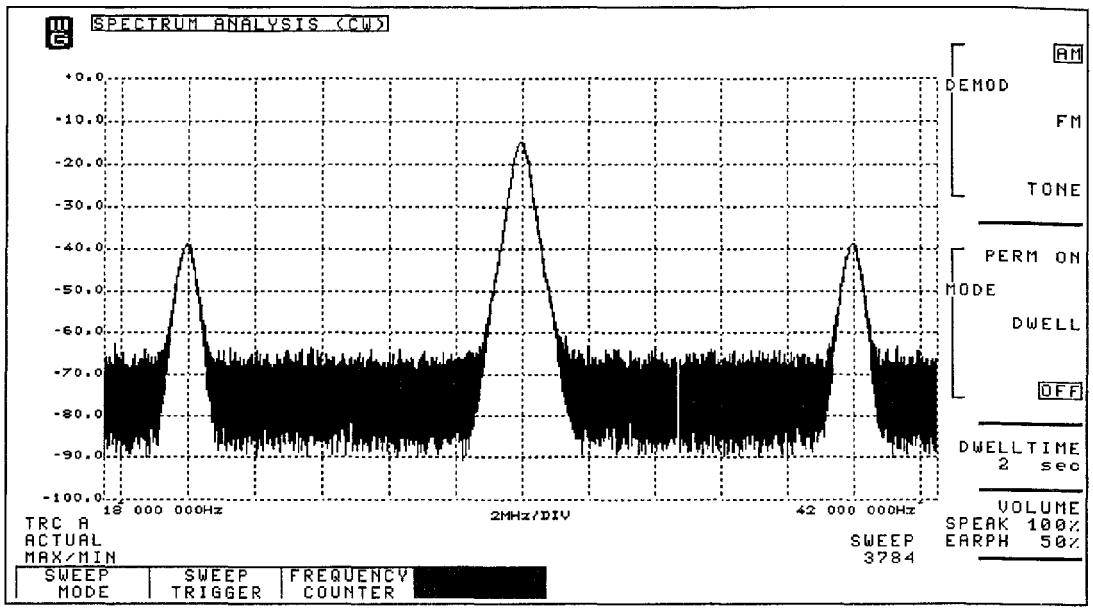
Numeric keypad --> [ENTER]

Resolution 0.01 dB

Default setting

-100.00 dBm

5.8 DEMODULATOR



5.8.1 DEMOD AM / FM / TONE

Meaning

Demodulation type.

This function determines how the signal is demodulated by the demodulator.

AM = Amplitude demodulation.

FM = Frequency demodulation.

TONE = Demodulation of single tones. These generate a whistling tone, the frequency of which is equal to the tuning frequency offset. This demodulation type is very good for identifying small, discrete interference in the noise.

Make choice

With **[SF1]** = AM
[SF2] = FM
[SF3] = TONE

Default setting

AM

5.8.2 MODE PERM ON/DWELL/OFF

Meaning

Demodulator evaluation time

This function determines the length of time for which the demodulator demodulates the signal.

MODE PERM ON = The demodulator remains permanently switched on.

MODE DWELL = The demodulator is switched off during the sweep between FSTART and FSTOP. The instrument is then tuned to the frequency of the active marker and the demodulator is switched on. After the time preset with the "DWELL TIME n sec" parameter elapses, the demodulator is switched off again, FSTART is set and a new sweep starts.

MODE OFF = The demodulator remains permanently switched off.

Make choice With **[SF4]** = PERM ON
[SF5] = DWELL
[SF6] = OFF

Default setting OFF

5.8.3 DWELL TIME

Meaning Demodulator dwell time
The demodulator remains switched on in DWELL MODE for the time specified here.

Open input With **[SF7]**

Setting range 1 ... 72 000 s (20 h)

Set with **Rotary control, step keys, numeric keypad --> [ENTER]**
Resolution 1 s

Default setting 2 s

5.8.4 VOLUME SPEAK

Meaning Demodulator volume for the loudspeaker
This function determines the volume of the demodulated signal which is audible via the built-in loudspeaker.

Open input With **[SF8]**; toggle with VOLUME EARPHONE

Setting range 0% (OFF) ... 100% (maximum volume)

Set with **Rotary control, step keys**
Resolution 10%
Numeric keypad --> [ENTER]
Resolution 1%

Default setting 100%

5.8.5 VOLUME EARPH

Meaning Demodulator volume for the earphone
The demodulated signal is also available at the earphone socket [60] on the backplane of the SNA. The earphone volume can be set with VOLUME EARPHONE.

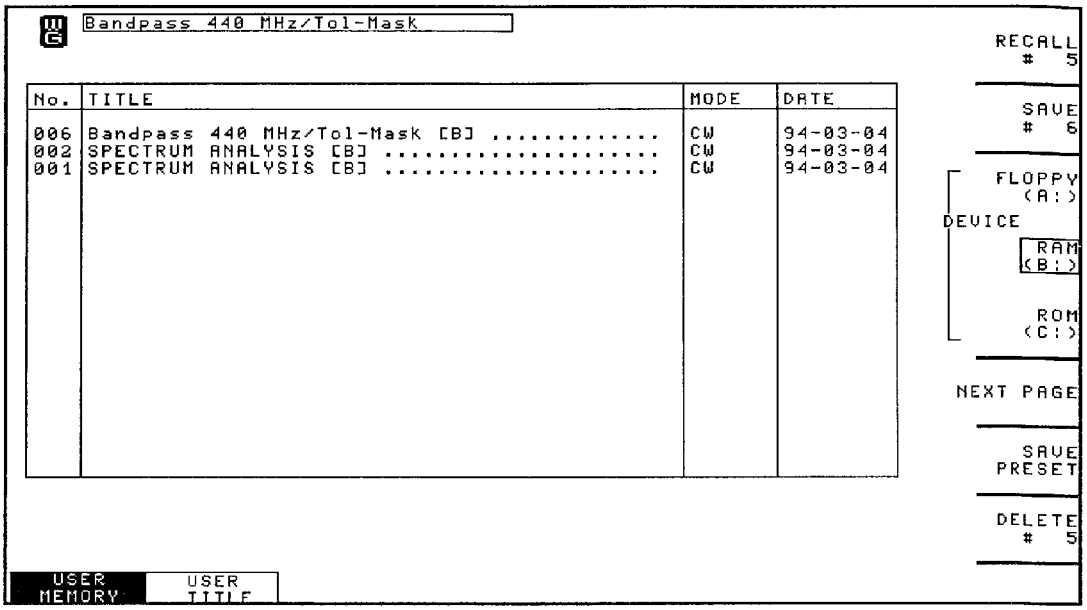
Open input With **[SF8]**; toggle with VOLUME SPEAKER

Setting range 0% (OFF) ... 100% (maximum volume)

Set with **Rotary control, step keys**
Resolution 10%
Numeric keypad --> [ENTER]
Resolution 1%

Default setting 50%

5.9 USER MEM, Saving and recalling instrument setups and results



Instrument setups which are used frequently can be saved with individual titles and then recalled later on. They can be saved:

- In the internal RAM (DEVICE B:)

- On the diskette in the floppy drive (DEVICE A:). The initial setting, for example, which can only be called up but not altered, is saved in the ROM.

The contents of the internal RAM remain stored after the instrument is switched off, due to the data backup facility. Around 500 KB is reserved for setups.

The read and write operations for diskettes take slightly longer; on the other hand, there is practically no limit to the storage capacity.

IMPORTANT!

Always make backup copies of important data!

If you press the "USER MEM" key, the contents of the selected "DEVICE" will be read and a list of these contents output on the display in the form of a table.

5.9.1 USER MEMORY

5.9.1.1 RECALL

Meaning Recalls the setup with the selected number on the selected DEVICE

Open input After pressing the **[USER MEM]** key, with **[SF1]**

Setting range Dependent on the capacity of the DEVICE (RAM, diskette) and the contents of the setup (parameters, measurement curve, tolerance mask, etc.)

Set with **Rotary control, step keys, numeric keypad --> [ENTER]**
Resolution 1

Default setting 1

5.9.1.2 SAVE

Meaning Saves the setup with the selected number on the selected DEVICE

Open input After pressing the **[USER MEM]** key, with **[SF2]**

Setting range Dependent on the capacity of the DEVICE (RAM, diskette) and the contents of the setup (parameters, measurement curve, tolerance mask, etc.)

Set with **Rotary control, step keys, numeric keypad --> [ENTER]**
Resolution 1

Default setting 1

5.9.1.3 DEVICE FLOPPY (A:) / RAM (B:) / ROM (C:)

Meaning Determines the data carrier from which the setup is to be read or to which it is to be saved

FLOPPY (A:) = The built-in floppy drive reads and writes to 3 1/2" diskettes in DOS format (HD and DD). The transfer procedure takes slightly longer than when the internal memory is used, for technical reasons. The setups can be read and modified using any ASCII editor.

RAM (B:) = Around 500 KB is reserved for setups; the memory contents are not lost, due to the data backup facility.

ROM (C:) = The DEFAULT PRESET from W&G is stored in ROM (see 3.7.2.1 on page 3-7).

Make choice After pressing the **[USER MEM]** key, with
[SF3] FLOPPY (A:)
[SF4] RAM (B:)
[SF5] ROM (C:)

Default setting RAM (B:)

5.9.1.4 NEXT PAGE

Meaning It is possible to save more setups than will fit on one page of the list of contents. You can call up the other page(s) with [SF6].

Activate function After pressing the **[USER MEM]** key, with **[SF6]**

5.9.1.5 SAVE PRESET

Meaning

The current instrument settings are stored as a USER PRESET. You can make up your own parameter settings and store them in this manner. The USER PRESET can be defined only in SPECTRUM ANALYSIS mode. However, the data set also includes the selected printer or plotter and the selected interface as set in the CONFIGURATION menu.
If you define a USER PRESET, its settings are automatically made available immediately after the instrument is powered on. You can also make these settings by pressing the PRESET key (see also Abschnitt 3.7.1.1 auf Seite 3-6).
If no USER PRESET is defined, the settings of the DEFAULT PRESET are used (see also Abschnitt 3.7.2.1 auf Seite 3-7).

Activate function

After pressing the **[USER MEM]** key, with **[SF7]**

5.9.1.6 DELETE

Meaning

Deletes the setup with the selected number on the selected DEVICE

Open input

After pressing the **[USER MEM]** key, with **[SF8]**

Setting range

Dependent on the capacity of the DEVICE (RAM, diskette) and the contents of the setup (parameters, measurement curve, tolerance mask, etc.)

Set with

Rotary control, step keys, numeric keypad --> [ENTER]
Resolution 1

Default setting

1

5.9.2 USER TITLE

Meaning

You can also reach this menu in the Display menu. It is described there (see 5.5.1 on page 5-32).

5.10 Generator operation—TG-20/TG-23

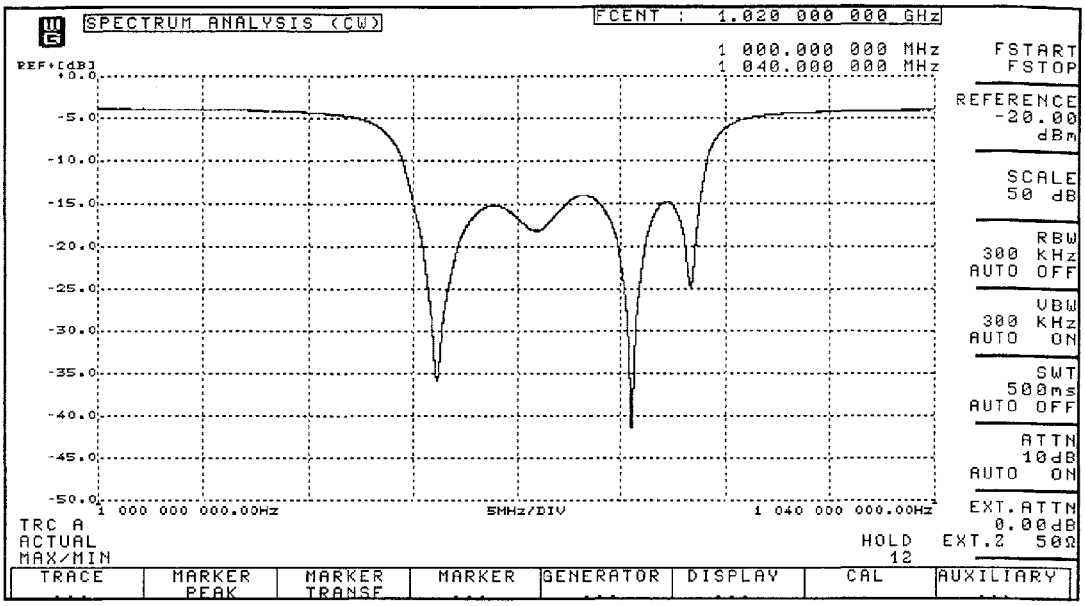


Fig. 5-6 Main menu with "Generator" softkey (the connected TG was detected)

[F5] has the "Generator" label only if a generator is detected when the SNA is powered up. If so, the frequency limits of the SNA are automatically adapted to the frequency range of the TG. If you connect a generator when the SNA is already powered up, turn the SNA on and off again. If the SNA still does not detect the TG, check the cable connections.

5.10.1 Controls and connectors on the instrument

All the controls and connectors on the instrument are shown below in table form, together with a brief description of their meanings. The identification numbers used in the table correspond to the numbers on the instrument.

5.10.1.1 Instrument front panel

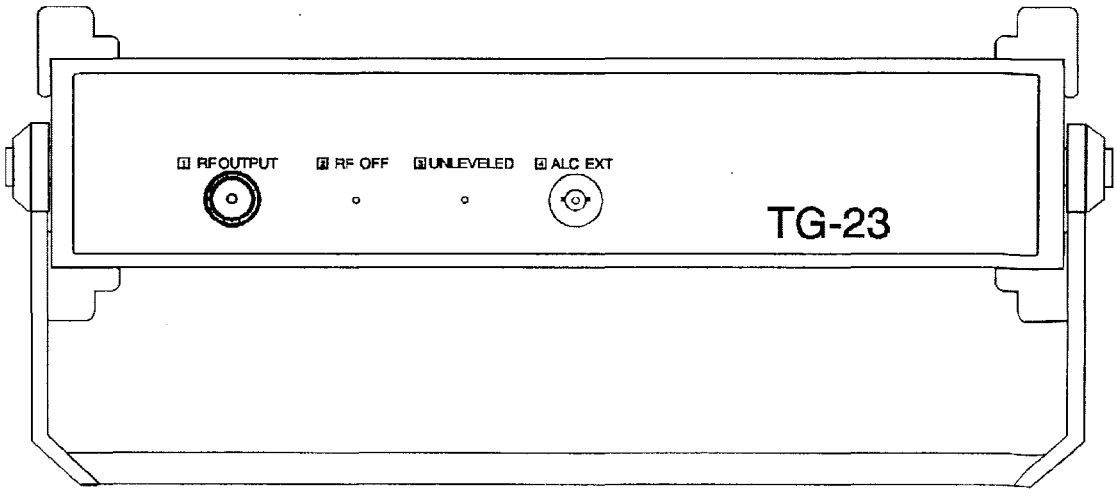


Fig. 5-7 Front view of the TG

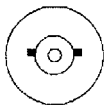
Ident no.	Control/Connector	Meaning
1	RF OUTPUT 	*Generator output* TG-20: 100 kHz to 3.2 GHz; Z_0 = 50 Ω; N connector (female). TG-23: 10 MHz to 26.5 GHz; Z_0 = 50 Ω; Exchangeable precision connector (EPC), fitted with insert for PC 3.5 (male) or N (female).
2	RF OFF 	*LED* The yellow LED lights up when the generator output is switched off (GENERATOR OFF parameter in the SNA menu). The yellow LED is dark when the generator output is switched on (GENERATOR ON parameter) or when the generator is not connected.
3	UNLEVELED 	*LED* The red LED lights up when the GEN LEVEL set on the screen does not correspond to the output level of the generator. The red LED is dark when the GEN LEVEL on the screen corresponds to the output level of the generator or when the generator is not connected. This LED lights briefly when the local oscillator (LO) jumps back from the stop frequency to the start frequency.
4	ALC EXT 	*Input for external ALC* The output of an EPM-1 Milliwatt Power Meter, diode detector or another power meter is connected to this BNC jack. This device provides the controlled magnitude for the output level if the ALC MODE EXT parameter is activated.

Fig. 5-8 Controls and connectors on the front of the instrument

5.10.1.2 Instrument back panel

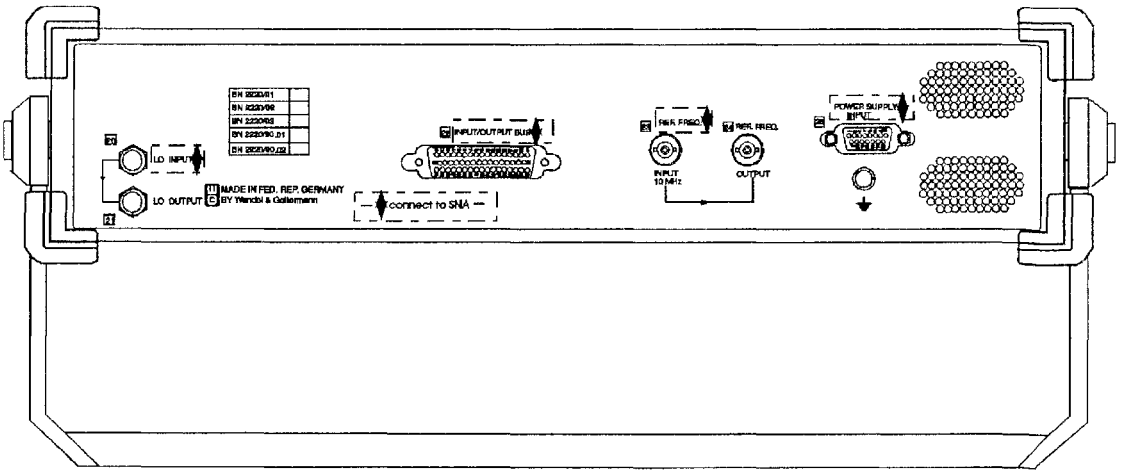


Fig. 5-9 Rear view of the TG

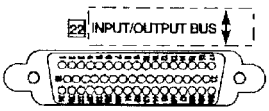
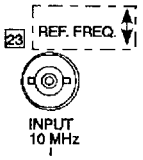
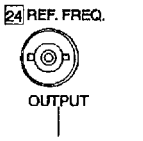
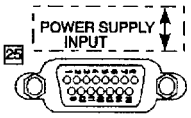
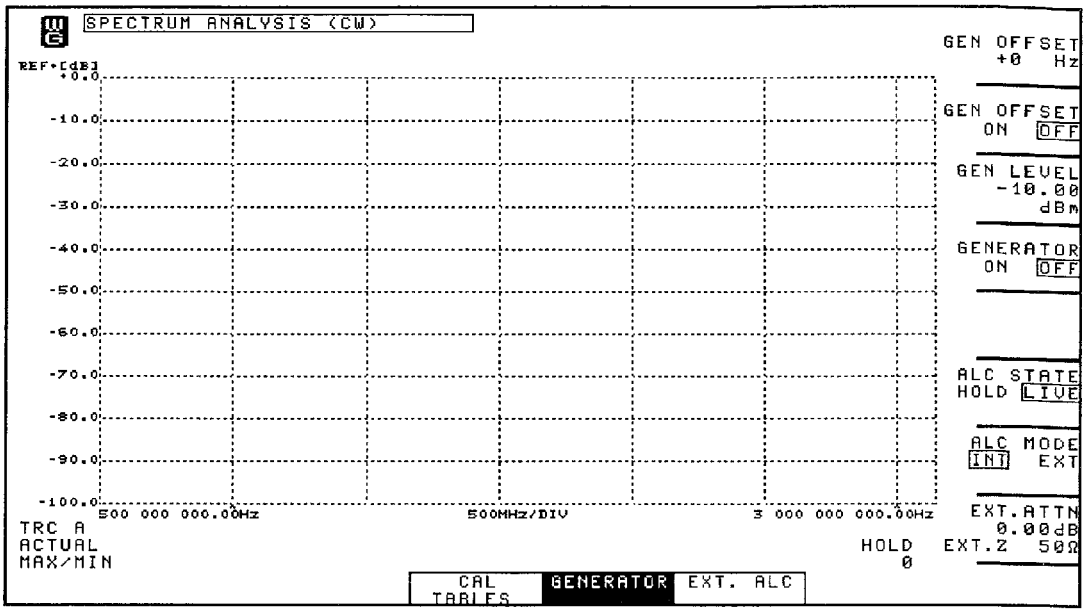
Ident. no	Control/connector	Meaning
20		*LO input* Input (SMA) for the local oscillator; Frequency: 3.5 to 7.8 GHz. Connect to jack [71] of the SNA (cable K 746). Be aware of the torque for SMA connectors!
21		*LO output* Output (SMA) of the local oscillator; Frequency: 3.5 to 7.8 GHz. Nominal level: +10 dBm into 50 Ω. This output must always be terminated during operation. When connecting the TG, use the terminating impedance of jack [71] of the SNA. Be aware of the torque for SMA connectors!
22		*INPUT/OUTPUT BUS* 50-pole SUB-D connector for controlling the tracking generator from the SNA. Connect this bus to jack [73] of the SNA. Use only the supplied cable (K 744)!
23		*INPUT REF. FREQ.* Input (BNC) for external reference frequency (10 MHz). Connect to jack [64] of the SNA (K 179).
24		*OUTPUT REF. FREQ.* Output (BNC) for reference frequency (10 MHz). The signal is looped through from input [23].
25		*TG POWER SUPPLY INPUT* 15-pole SUB-D connector for power supply from the SNA. Connect to jack [76] of the SNA (cable K 745).
		*Ground socket* Connect to the ground socket of the SNA (cable K 747).

Fig. 5-10 Controls and connectors on the back of the instrument

5.10.2 Measurement parameters in the Generator main menu

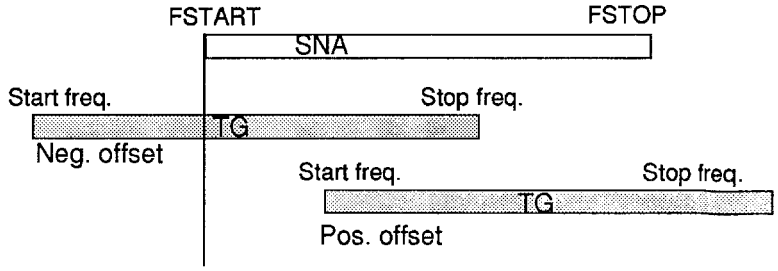


You can access this menu from the main menu or in the EXT ALC menu with [F5].

5.10.2.1 GEN OFFSET (generator frequency offset)

Meaning

The frequency range of the TG is shifted by the magnitude of the offset with respect to the SNA ($FSTART_{TG}=FSTART_{SNA}+OFFSET$). A positive value indicates that the generator frequency is higher than the receive frequency by the offset value, while a negative value means that the generator frequency is lower than the receive frequency.



The generator frequency offset does not go into effect until it is switched on with the parameter GEN OFFSET ON.
An offset is useful when making measurements on frequency converters, for example.

Open input

In the generator menu with [SF1]

Setting range

	Band 0	Other frequency bands
TG-20	-70 to +70 MHz	----
TG-23	-70 to +70 MHz	-140 to +140 MHz

Set with

Rotary control

Resolution FSPAN/500 (for FSPAN = 0 resolution RBW/50)

Step keys

FSTEP

Numeric keypad -> [ENTER]
Resolution 1 Hz

Default setting 0.00 Hz

5.10.2.2 GEN OFFSET ON/OFF

Meaning Turn the generator offset on/off. Set the offset value with the parameter GEN OFFSET.
ON = The offset value next to SF1 is in effect.
OFF = This setting is equivalent to GEN OFFSET = 0 Hz.

Toggle In the **Generator menu** with **[SF2]** ON/OFF

Default setting OFF

5.10.2.3 GENerator LEVEL

Meaning Output level of the generator when terminated into 50 Ω. This parameter is also found in the CAL TABLES submenu.
If external adapters are used, specify their value exactly as EXTERN ATTN/EXTERN Z. Then, the level will apply to the output of these adapters.
The output level is not present until the GENERATOR parameter is set to ON.

Open input In the **Generator menu** or **CAL TABLES menu** with **[SF3]**

Setting range -20 dBm to +10.00 dBm
-80 dBm to +10.00 dBm if the output attenuator is installed (option BN 2220/90.01 for TG-20 or BN 2220/90.02 for TG-23)

Set with
Rotary control
Resolution LSTEP
Step keys
LSTEP
Numeric keypad -> [ENTER]
Resolution 0.1 dB

Default setting -10.00 dBm

5.10.2.4 GENERATOR ON/OFF

Meaning Turn generator output level on/off.
ON = The output level is available at the output. The level value is specified with the GEN LEVEL parameter in the Generator menu or in the CAL TABLES menu.
OFF = The output level is off.

Toggle In the **Generator menu** with **[SF4]** ON/OFF

Default setting OFF

5.10.2.5 ALC STATE HOLD/LIVE

Meaning

Track generator output level or freeze at current ALC level.

LIVE = ALC activated. Specify the regulation behavior and the output level with the ALC MODE INT/EXT, EXT ATTN/EXT Z parameters and the parameters in the EXT ALC menu.

HOLD = ALC off. The output level is frozen to the last setting which was attained with active ALC. The output level can no longer be altered with the "GEN LEVEL" parameter in this setting.

Attention: The parameters which specify the regulation behavior must suit the nominal value specifier at the time of the transition from the HOLD to the LIVE state.

The setting of the ALC STATE is stored when the TG is switched off and reinstated when the instrument is switched back on.

Toggle

In the **Generator menu** with **[SF6]** LIVE/HOLD

Default setting

LIVE

5.10.2.6 ALC MODE INT/EXT

Meaning

Selection of the nominal value specifier for regulation of the output level.

INT = The output level is regulated by the internal detector.

EXT = The output level of the generator must be measured using a detector or the probe of an EPM or other power meter, for example. Their level-dependent d.c. output signal is fed to the ALC input of the TG [4] as a nominal level value.

Attention: The parameters which specify the regulation behavior of the external sensors are found in submenus;
Use [F2] to access the EXT. ALC menu, or
[F8] to access the detector CAL TABLE. The data specified there must correspond to the connected sensor for ALC MODE EXT.

Toggle

In the **Generator menu** with **[SF7]** INT/EXT

Default setting

INT

5.10.2.7 EXTERN ATTN/EXTERN Z

Meaning

For some measurements, it is necessary to connect the device under test (DUT) to the generator output via adapters or attenuators (positive attenuation) or amplifiers (negative attenuation). Also, for small frequency spans, the attenuation of connection cables can be taken into account in this manner.
If the parameters for the adapter or attenuator are properly entered, then all values refer to the output of the adapter or attenuator.
EXTERN ATTN is used to take into account the magnitude of the attenuation or amplification, while EXTERN Z is used for the output impedance of the interconnected two-port network.

Open input

In the **Generator menu** with **[SF8]**, toggle betweenEXTERN ATTN and EXTERN Z

EXTERN ATTN

Setting range

The level is automatically tracked so that the set GEN LEVEL is produced at the output of the adapter. The allowable level window at the output of the TG is -20 dBm to +10.00 dBm (or -80 dBm to +10.00 dBm with the output attenuator option).

Set with

Rotary control, Step keys
Resolution LSTEP
Numeric keypad --> [ENTER]
Resolution 0.01 dB
Positive values = attenuation.
Negative values = amplification (gain).

Default setting

0.00 dB

EXTERN Z

Setting range

20 Ω to 3200 Ω

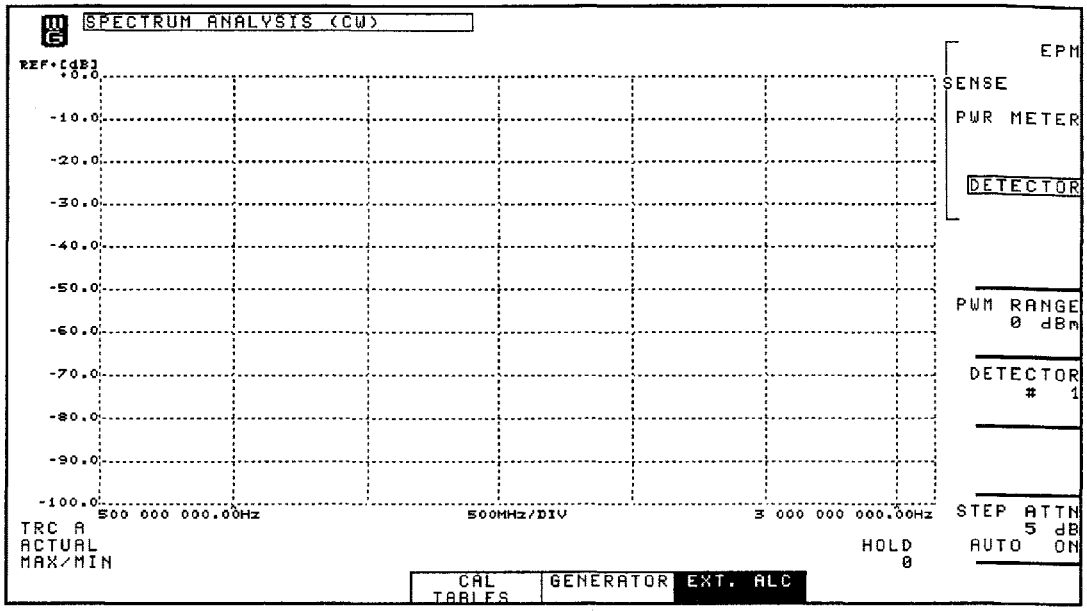
Set with

Rotary control
Resolution 5 Ω
Step keys
Resolution 5 Ω
Numeric keypad --> [ENTER]
Resolution 1 Ω

Default setting

50 Ω

5.10.3 EXT. ALC menu, ALC parameters for use with external sensors



Press [F6] in the Generator main menu to reach this submenu. This is where you make all settings for external ALC (**A**utomatic **L**evel **C**ontrol). These parameters do not go into effect as long as ALC MODE is set to INT in the Generator menu. They become valid when ALC MODE is set to EXT.

5.10.3.1 SENSE EPM / PWR Meter / DETECTOR

Meaning

Selection of the external sensor which generates the control voltage from the measured power for external ALC.

EPM = Control voltage generated by an EPM-.

PWR Meter = Control voltage generated by a power meter. The PWM RANGE specified next to [SF5] is interpreted as the full-scale value for the power meter (1 V control voltage).

DETECTOR = Control voltage generated by a diode detector. The values in the current CAL TABLE are interpreted as the characteristic of the detector. This table is stored in the CAL TABLES menu under the address specified next to [SF6], detector # n.

Toggle

In the **EXT. ALC menu**
with **[SF1]** Sense EPM
[SF2] Sense PWR Meter
[SF3] Sense DETECTOR

Default setting

EPM

5.10.3.2 PoWerMeter Range

Meaning

Range setting of the connected power meter.
Here, specify the power at which the power meter outputs its maximum control voltage (V = 1 V). It is assumed that the input power generates a proportional control voltage. This parameter goes into effect when "Sense PWR Meter" is set with [SF2].

Open input

In the **EXT. ALC menu** with **[SF5]**

Setting range

See connected power meter.

Set with

Rotary control
Resolution LSTEP
Step keys
LSTEP
Numeric keypad -> [ENTER]
Resolution 0.1 dB

Default setting

0.00 dBm

5.10.3.3 DETECTOR # n

Meaning

The CAL TABLE for the connected detector #n is loaded. "n" is the address under which the table is stored in the CAL TABLE menu. The CAL TABLE goes into effect as the characteristic for external ALC when "SENSE DETECTOR" is selected with [SF3].

Note: The current CAL TABLE is also transferred into the setup memory. A non-existent CAL TABLE which is called up results in the error message "DOES NOT EXIST".

Open input

In the **EXT. ALC menu** with **[SF6]**

Setting range

1 to 9

Set with

Rotary control, Step keys, Numeric keypad -> [ENTER]
Resolution 1

Default setting

1

5.10.3.4 STEP ATTN

Meaning

Output attenuation = attenuation of the generator signal at the output jack. For "AUTO ON", the output attenuation is coupled to the output level.

Open input

In the **EXT. ALC menu** with **[SF8]**

Setting range

0 dB without the output attenuator;
0 to 65 dB with the output attenuator installed
(option BN 2220/90.01 for TG-20 or BN 2220/90.02 for TG-23)

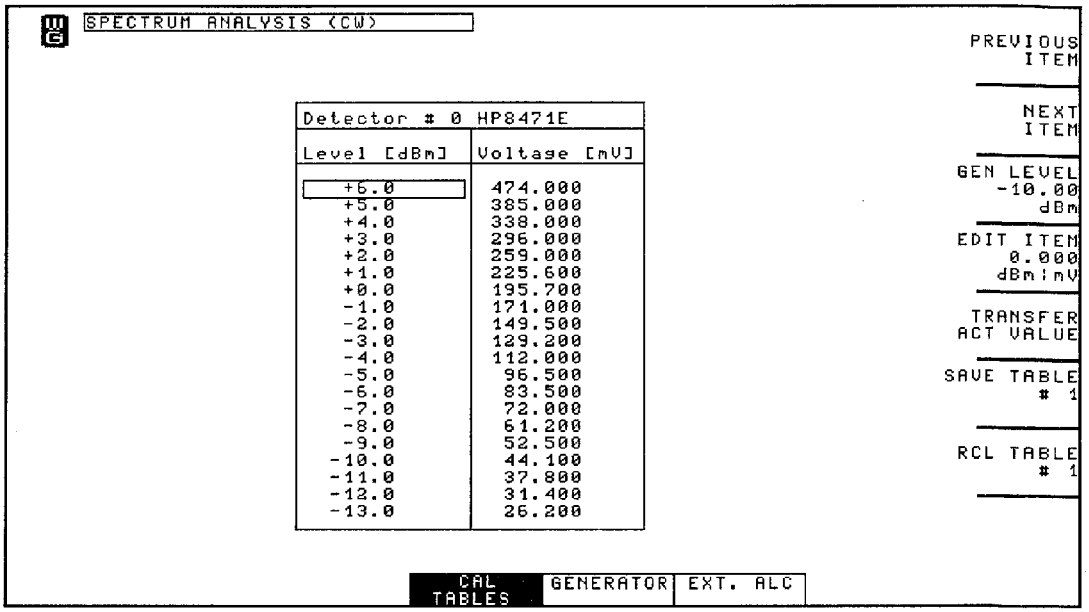
Set with

In the **EXT. ALC menu** with the **AUTO key**
Automatic coupling to the GEN LEVEL (ON/OFF)
AUTO OFF when changing the STEP ATTN with the
Rotary control, Step keys
Resolution 5 dB in the range 5 to 65 dB
Numeric keypad --> [ENTER]
Resolution 5 dB in the range 0 to 65 dB

Default setting

0 dB/AUTO ON

5.10.4 CAL TABLES, Detector characteristic menu



This menu is used to enter or display the characteristic of an external detector in the form of a table of values. The table corrects the non-linear relationship between the input level to the detector and the output voltage. Each pair of values shows the input power in the left column (LEVEL) and the d.c. voltage produced by the detector in the right column (VOLTAGE).

Call up this menu using [F4] in the Generator menu. When you do this:

- ALC INT is automatically switched on. This means that incorrect entries will not produce unpredictable results.
- The table currently loaded is displayed. This table can be edited independently of the stored values.
- The box is placed on the point which was last selected. When a new table is called up, the box is placed on the top level value in the left column.

Softkeys [SF1] to [SF7] are used to **enter** and **check the values**. Use "Previous Item" or "Next Item" to choose the position in the table to be edited.
Use EDIT ITEM to **enter** values (which can be taken from a diagram, for example).
Use TRANSFER ACTUAL VALUE to **transfer** current settings or measured values from the SNA into the table. It is permissible to fill only the top part of the table with valid values. The **end of the table** must then be indicated by a value equal to or larger than the value in the cell above it. The ALC then functions only in the defined range.
For less than two valid values, a default characteristic is assumed. If only one valid pair of values is present, the default characteristic is adapted to this point. The following values are not overwritten, which makes it easier to correct erroneous entries.

The table which is currently being edited is independent of the stored tables. To put the table into effect, it must be stored first. For less than 15 entries, the **end of the table** is indicated by the pair -99.00 dBm/ 0.000 mV.

Nine tables with a maximum of 15 pairs of values can be **stored** and **recalled**. The memory address n of the current table is visible in the EXT. ALC menu as DETECTOR # n. See also Chapter 10.

The table is stored in ASCII format. You can alter it later using an editor. It is also possible to enter a title for the table (e.g. detector type) in this manner.

Detector #5		Title (appears in the menu in the first line)
3		Memory location
9		Number of valid pairs
8.00	49.860	1st value Level in dBm (left) | Voltage in mV (right)
5.00	28.101	2nd value
2.00	15.486	3rd value
-1.00	8.205	4th value
-4.00	4.384	5th value
-7.00	2.450	6th value
-10.00	1.057	7th value
-13.00	0.814	8th value
-16.00	0.636	9th value
-99.00	0.000	End identifier (internally generated)
-22.00	0.119	Invalid value from an earlier table

5.10.4.1 PREVious ITEM

Meaning Open previous item in the table for input.
You can now edit the current value, which is marked by a box. Each time you press [SF1], the box moves up one item to the left or right.

Activate function In the **CAL TABLES menu** with **[SF1]**

5.10.4.2 NEXT ITEM

Meaning Open next item in the table for input.
You can now edit the current value, which is marked by a box. Each time you press [SF2], the box moves down one item to the left or right.

Activate function In the **CAL TABLES menu** with **[SF2]**

5.10.4.3 GEN LEVEL (see 5.10.2.3 on page 5-60)

Meaning Output level of the generator. This softkey has the same function as in the Generator menu.

5.10.4.4 EDIT ITEM

Meaning

Use EDIT ITEM to enter or edit values in the table (which can be taken from a diagram, for example).
Select the position in the table with PREV ITEM or NEXT ITEM.

Enter/Edit the new value. If the box is in the LEVEL column, the value you enter is an input level; if the box is in the VOLTAGE column, the value is an ALC d.c. voltage.

Attention: Enter the input power and accompanying output voltage of the detector from top to bottom in decreasing order. An interruption in the sequence (i.e. a value which is greater than or equal to the previous) is interpreted as an end identifier. Any values which follow are ignored.
The level threshold of the ALC input is approx. 3 mV. Smaller input voltages cause the maximum output level of the TG to be set.

Open input

In the **CAL TABLES menu** with **[SF4]**

Setting range

Current LEVEL value:
-20 dBm to +10.00 dBm
-80 dBm to +10.00 dBm if the output attenuator is installed (option BN 2220/90.01 for TG-20 or BN 2220/90.02 for TG-23)

Set with

Rotary control
Resolution LSTEP
Step keys
LSTEP
Numeric keypad -> [ENTER]
Resolution 0.1 dB/0.01 mV

Default setting

0.00 dBm

5.10.4.5 TRANSFER ACTUAL VALUE

Meaning

The current setting or measured value is transferred.
- If the box is in the LEVEL column, the current output level of the TG (see [SF3]) is copied into the table.
- If the box is in the VOLTAGE column, the current ALC input level of the SNA is copied into the table.

Activate function

In the **CAL TABLES menu** with **[SF5]**

5.10.4.6 SAVE TABLE #n

Meaning

Save the CAL TABLE for the connected detector n. "n" is the address under which the table is stored. The CAL TABLE is interpreted as the characteristic for external ALC if "SENSE DETECTOR" is selected with softkey [SF3] in the ALC EXT menu. The current CAL TABLE is also transferred to the setup memory. "DETECTOR # 0" is entered as the default title for a new table.

Note: **An existing CAL TABLE at this address is overwritten with NO warning.**

Open input

In the **CAL TABLES menu** with **[SF6]**

Setting range

1 to 9

Set with

Numeric keypad -> [ENTER]
Resolution 1

Default setting

1

5.10.4.7 ReCaLl TABLE #n

Meaning

Load CAL TABLE for processing. "n" is the address under which the table was stored in the CAL TABLE menu. It is independent of the CAL TABLE which is loaded with DETECTOR #n for the current detector in the ALC. EXT menu.

Note: A non-existent CAL TABLE produces the error message "DATA OUT OF RANGE".

Open input

In the **CAL TABLES menu** with **[SF7]**

Setting range

1 to 9

Set with

Rotary control, Step keys, Numeric keypad -> [ENTER]
Resolution 1

Default setting

1

5.11 SPECTRUM ANALYSIS (EXT MIXER) mode

External mixers can be used to extend the frequency range of the SNA. It is thus possible to make measurements beyond the upper frequency limit of the instrument. The Spectrum Analysis (EXT MIXER) mode provides access to all parameters so that various types of external mixers can be used with the SNA.

Test setup

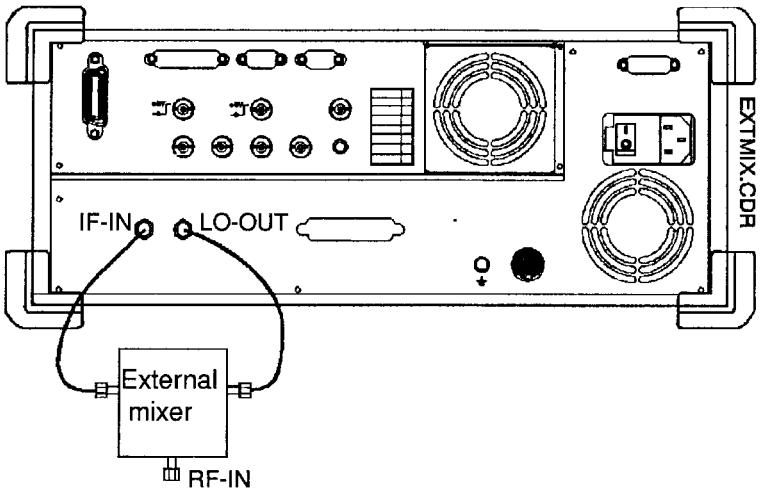


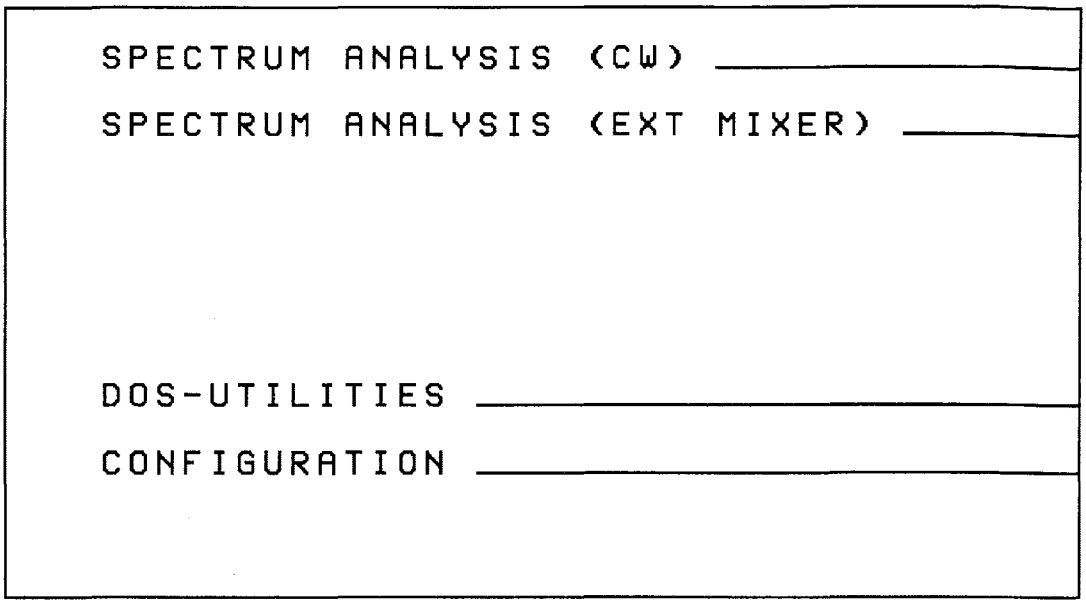
Fig. 5-11 Connecting an external mixer

- Connect the output of the local oscillator on the back panel of the SNA to the LO input of the external mixer.
- Connect the IF input of the SNA to the IF output of the mixer. The mixer diode is fed a digitally adjustable bias current of -12.8 to +12.8 mA via this input.

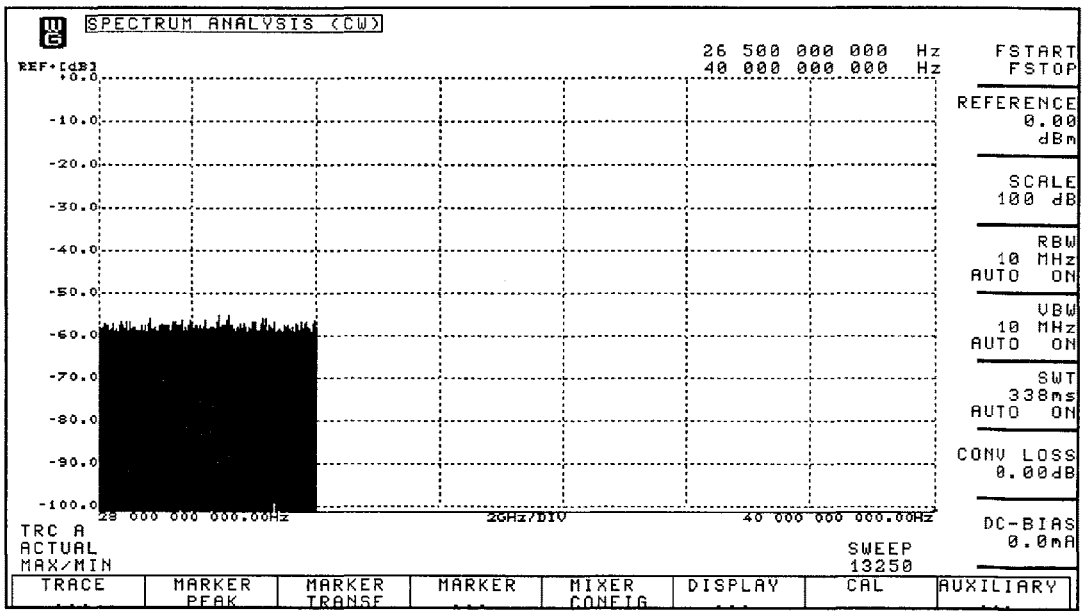
The LO frequency range of the SNA is 3.5 to 7.8 GHz; the nominal output level is +10 dBm into 50 Ω. The intermediate frequency (IF) of the SNA is 421.99 MHz; the level range for full-scale of the results display is -75 to -15 dBm.
Parameters are used to tell the SNA:
- With what harmonic the mixer converts its input signal;
- The conversion loss of the mixer;
- The bias current for the mixer diode.

Note: The SNA will work with any external mixer capable of processing an LO frequency between 3.5 and 7.8 GHz and an IF of 421.99 MHz. Separate connectors must be used for the LO and IF (diplexer connector = frequency diplexer).

- To call up this mode, press the **MODE** key



- Press **[SF2]** to call up the mode measuring screen



Compared with the Spectrum Analysis (CW) mode, two parameters have changed.

Conversion loss

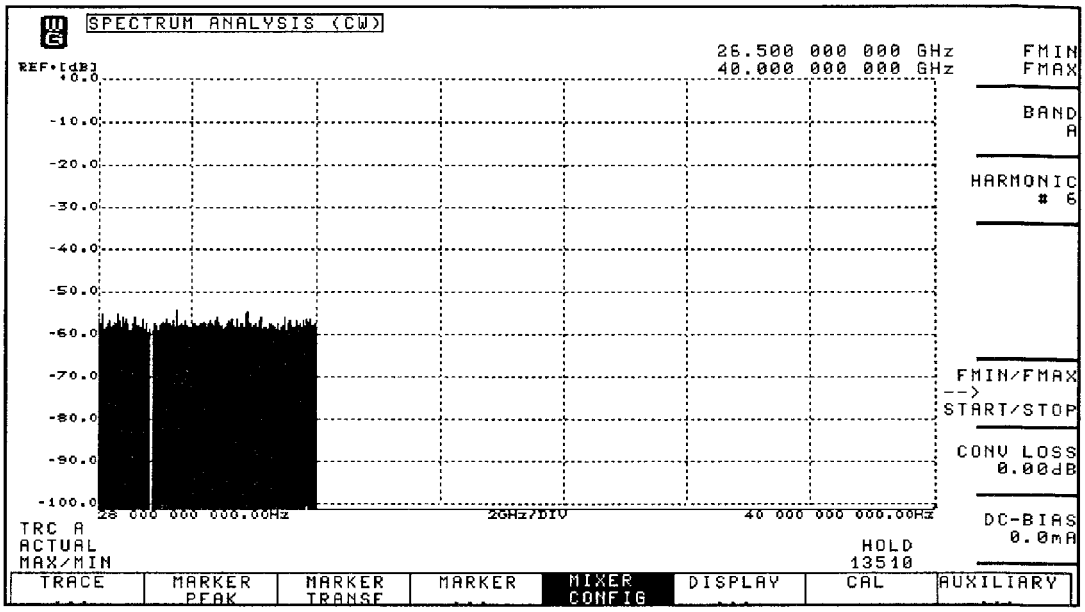
The function of the input attenuator is missing since the analyzed signal is no longer passed via the input jack of the SNA. Instead, the conversion loss can be entered. Conversion loss is due to the mixing losses of the external mixer; such losses are normally frequency-dependent. See the data sheet of the mixer for the correct value. This parameter influences the amplitude accuracy of the SNA.

DC-BIAS

A d.c. current can be fed in via the IF connector for use in setting the bias point of the mixer. This determines the mixing losses. By varying the d.c. current, the attenuation minimum (for example) can be determined experimentally if you don't have a data sheet specification.

In the MIXER CONFIG submenu, you can set:
- Predefined frequency bands
- Band limits
- The harmonic of frequency conversion.

• Press **[F6]** to call up the MIXER CONFIG submenu



5.11.1 FMIN

Meaning

Limit for the start frequency when using an external mixer. If you select a known frequency band with [SF2], the lower band limit is automatically set. Along with FMAX, this parameter specifies the frequency range in which the external mixer is to operate.

Note: Based on the frequency range and the known values for the LO range and the IF frequency, the SNA computes the possible harmonics with which the mixer can operate.

Open input

In the MIXER CONFIG submenu of the SPECTRUM ANALYSIS (EXT MIXER) mode
with **[SF1]** (toggles with FMAX)

Setting range

Predefined by the choice of frequency band with [SF2].

Set with

Rotary control
Resolution 1-2-5 multiples
Step keys
Resolution FSTEP
Keypad -> [ENTER]
Resolution 1 Hz

Default setting

26.5 GHz

5.11.2 FMAX

Meaning

Limit for the stop frequency when using an external mixer. When you select a known frequency band with [SF2], the upper band limit is automatically set. Along with FMIN, this parameter specifies the frequency range in which the external mixer is to operate.

Note: Based on the frequency range and the known values for the LO range and the IF frequency, the SNA computes the possible harmonics with which the mixer can operate.

Open input

In the MIXER CONFIG submenu of the SPECTRUM ANALYSIS (EXT MIXER) mode
with **[SF1]** (toggles with FMIN)

Setting range

Predefined by the choice of frequency band with [SF2].

Set with

Rotary control
Resolution 1-2-5 multiples
Step keys
Resolution FSTEP
Keypad -> [ENTER]
Resolution 1 Hz

Default setting

40.0 GHz

5.11.3 BAND X

Meaning

Frequency band when using an external mixer. The frequency limits are automatically set when you select the frequency band.

Open input

In the MIXER CONFIG submenu of the SPECTRUM ANALYSIS (EXT MIXER) mode
with **[SF2]**

Setting range

Band	FMIN-FMAX (GHz)	HARMONIC # n
K	18-26.5	4-5
A	26.5-40	6-7
Q	33-50	7-9
U	40-60	8-11
V	50-75	10-14
E	60-90	12-17
W	75-110	14-21
F	90-140	18-25
D	110-170	22-31
G	140-220	28-39
Y	170-260	33-48
J	220-330	42-62
K	18-26.5	4-5

Set with **Step keys, scrolling**

Default setting Band A

5.11.4 HARMONIC # n

Meaning The SNA computes the harmonics with which the input signal can be displayed on the screen. This is based on the selected frequency band and the set frequency range FMIN to FMAX and the LO range with the IF frequency. The harmonic must cover the lower **and** upper frequency limit.

Note: From the possible harmonics, the SNA always selects the lowest one in order to minimize the conversion loss. The harmonic can be changed if the mixer requires an even or odd n.

Open input In the MIXER CONFIG submenu of the SPECTRUM ANALYSIS (EXT MIXER) mode
with **[SF3]**

Setting range Dependent on FMIN, FMAX and the LO range or IF frequency.

Set with **Rotary control, Step keys, Keypad -> [ENTER]**
Resolution 1

Default setting HARMONIC # 6

5.11.5 FMIN/FMAX --> START/STOP

Meaning Transfer the frequency limits set in the MixerConfig menu to the start and stop frequencies in the measuring screen

Activate function In the MIXER CONFIG submenu of the SPECTRUM ANALYSIS (EXT MIXER) mode
with [SF6]

5.11.6 CONV LOSS

Meaning Conversion loss is used to take into account the amount of attenuation or amplification of the signal due to the external mixer. You must enter the power loss. If all you know is the voltage loss, compute the power loss using the following formula:
Power loss = Voltage loss - 10 log (IMP/50 Ω).
The specification of the conversion loss determines the accuracy of the displayed level.

Open input In the MIXER CONFIG submenu of the SPECTRUM ANALYSIS (EXT MIXER) mode
with **[SF7]**

Setting range - 20.00 dB to +100 dB

Set with **Rotary control, Step keys**

Resolution LSTEP
Keypad --> [ENTER]
Resolution 0.01 dB
Positive values = attenuation
Negatives values = amplification (gain).

Default setting 0.00 dB

5.11.7 DC-BIAS

Meaning D.C. current for setting the bias of the mixer diode (to minimize the conversion losses). This current is fed to the external mixer via the IF connector.

Note: See the data sheet of your mixer to find out at which bias current the conversion losses are the lowest. If you can't find this information, you can vary the bias current to determine the minimum loss experimentally.

Open input In the MIXER CONFIG submenu of the SPECTRUM ANALYSIS (EXT MIXER) mode
with **[SF8]**

Setting range -12.8 mA to +12.8 mA

Set with **Rotary control, Step keys, Keypad --> [m key]**
Resolution 0.1 mA

Default setting 0.0 mA

5.12 CONFIGURATION

5.12.1 IEEE 488/IEC 625

5.12.1.1 ADDRESS

Meaning

IEEE/IEC instrument address of the SNA

The current address is displayed (in the CONFIGURATION/IEEE 488 (IEC 625) menu) and can be altered.

No more than 15 instruments can normally be connected to one interface.

Please also note the address of the system controller and certain standard addresses, e.g. those of the plotter or printer.

Note: Each address can only be allocated once in an IEC bus system.

Open input

After pressing **[MODE]** --> **[SF7]** --> **[F1]**, with **[SF1]**

Setting range

0 ... 30

Set with

Rotary control, step keys, numeric keypad --> [ENTER]

Resolution 1

Default setting

4

5.12.1.2 SYST CONTR ON/OFF

Meaning

Assign or disable system controller features.

ON = Used during manual operation to control a plotter connected externally.

OFF = For remote control operation. This is the only way to have the SNA controlled by an external controller. Using the PASS CONTROL function, the system controller feature can be temporarily passed to the SNA.

Toggle

After pressing [MODE] --> [F7] --> [SF1] with [F2]

Default setting

OFF

5.12.2 DISPLAY

5.12.2.1 DISPLAY SCREEN INT/EXT

Meaning

The measurement is displayed on the internal or external monitor.

DISPLAY SCREEN INT = The measurement is displayed on the built-in electroluminescent monitor.

DISPLAY SCREEN EXT = The measurement is displayed on the external EGA monitor connected to the socket [53] on the backplane.

Toggle

After pressing **[MODE]** --> **[SF7]** --> **[F4]**, with **[SF1]**

Default setting

INT

5.12.2.2 PALETTE INTERN

Meaning

Color range of the built-in monitor.
The range determines which colors are used to represent the various display elements (graticule, measurement curve, tolerance mask, etc.).

Open input

With [SF2] after pressing [MODE] --> [SF7] --> [F4]

Setting range

0 ... 15

Set with

Rotary control, step keys, numeric keypad --> [ENTER]
Resolution 1

Default setting

0

5.12.2.3 PALETTE EXTERN

Meaning

Color range of the monitor connected to the socket [53].
The range determines which colors are used to represent the various display elements (graticule, measurement curve, tolerance mask, etc.).

Open input

After pressing **[MODE]** --> **[SF7]** --> **[F4]**, with **[SF3]**

Setting range

0 ... 7

Set with

Rotary control, step keys, numeric keypad --> [ENTER]
Resolution 1

Default setting

0

5.12.3 HARDCOPY

5.12.3.1 DEVICE

Meaning

Connected printer type.
The printer type which is entered here determines the functions which can be used, e.g. the number of fonts, expanded or condensed type, character formats such as superscript and subscript, graphics capabilities, etc. These functions are taken into account when the printer commands are output.

Note: If your printer is not listed here, check in its manual whether it can emulate one of the printers listed here.

Setting range

EPSON FX 80 or Epson-compatible dot-matrix printer (9)
EPSON LQ 800 or Epson-compatible dot-matrix printer (24)
HP Laserjet
HP Deskjet
HP Thinkjet

Make choice

After pressing **[MODE]** --> **[SF7]** --> **[F5]**, with **[SF1]**

Default setting

TYPE EPSON FX 80

5.12.3.2 DESTINATion SERIAL/PARALLEL/IEC

Meaning

Printer or plotter interface. The term "printer" refers to a device which is capable of printing out ASCII characters and value tables; a "plotter" is a device which outputs graphics, e.g. measurement curves, tolerance limits. A printer may also have a graphics capability.

SERIAL = The plotter or printer commands are transmitted via serial interface.

PARALLEL = The plotter or printer commands are transmitted via the parallel interface.

IEEE/IEC = The printer or plotter commands are sent to the IEEE interface. The IEEE address of the connected device must agree with the address entered in the "CONFIGURATION HARDCOPY" menu.

Make choice

For PRINTER after pressing **[MODE] --> [SF7] --> [F5]**
With **[SF3]** INTERFACE SERIAL
With **[SF4]** INTERFACE PARALLEL
With **[SF5]** IEEE/IEC

Default setting

PARALLEL

5.12.3.3 HARDCOPY ADDRESS # n

Make choice

IEEE device address of the printer or plotter.

The current address is displayed in the CONFIGURATION/ HARDCOPY menu and can also be altered there.

Only 15 devices may be connected to an interface.

Please note also the address of the system controller or the standard addresses (e.g. of the generator and receiver).

Note: In an IEEE bus system, an address may be assigned only once.

Open input

After pressing [MODE] --> [SF7] --> [F5] with [SF7]

Setting range

0 to 30

Set with

Rotary control, step keys, keypad -> [ENTER]

Resolution 1

Default setting

1

Default setting

29

6 Remote control

6 Remote control

6.1 Introduction

Standards

The SNA is a processor-controlled measuring instrument. All the functions and parameters which can be programmed manually can also be controlled using an external controller. A remote control interface is integrated in the SNA for this purpose.

The behavior of the instrument when remote-controlled conforms to the IEC 625.1/IEEE 488.1 - 1978 and IEC 625.2/IEEE 488.2 - 1987 standards (referred to below as IEC/IEEE).

SCPI (Standard Commands for Programmable Instruments), which is based on the 488.2 standard, specifies a standardized set of commands for remote control, with standardized syntax and semantics. The remote control commands which are implemented for the SNA are structured according to the SCPI rules.

LOCAL operation

It is possible to change over to manual operation from remote control mode by pressing the LOCAL key, unless LOCAL LOCKOUT has been programmed.

Bar code

Even if an IEEE bus computer is not available, the SNA can be set quickly and easily, e.g. for routine measurements, using a bar code reader. The BCI-1 bar code interface in the W&G range of accessories is needed to do so.

6.2 IEEE remote control interface of the SNA

6.2.1 Bus connections

Overview

Up to 15 devices can be connected together in an interface system using special IEEE bus cables. The maximum permissible cable length which can be used when a group of devices is connected together in a bus system is 2 m times the number of devices, though no more than 15 m. None of the individual cables must be more than 2 m long.

See also IEC 625 Part 1, Section 39, Page 71.

Terminal strip

The built-in IEC bus board is equipped with a 24-pole terminal strip, the pinning of which is shown below.

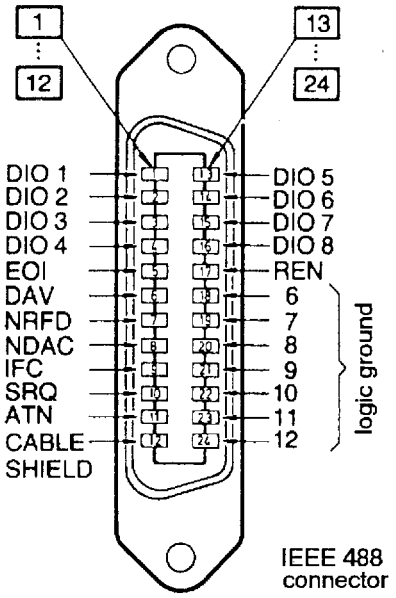


Fig. 6-1 Pinning of the IEEE bus connector of the SNA

IEC/IEEE bus cables

IEEE bus cables in various lengths are available for connecting the SNA to other devices or controllers:

- 1.2 m long: K 420

- 2.0 m long: K 421

6.2.2 ADDRESS, Device address

Programming word

Each device must be given a unique address, to allow it to be activated directly by the controller in a measurement system.

Menu path

```
├──CONFIGURATION
    ├──IEEE 488/IEC 625
        └──ADDRESS 0 ... 30
```

Open input

With [CONFIGURATION]

Setting range

0 to 30

Set with

Numeric keypad --> [ENTER]
Rotary control
STEP keys

Default setting

4

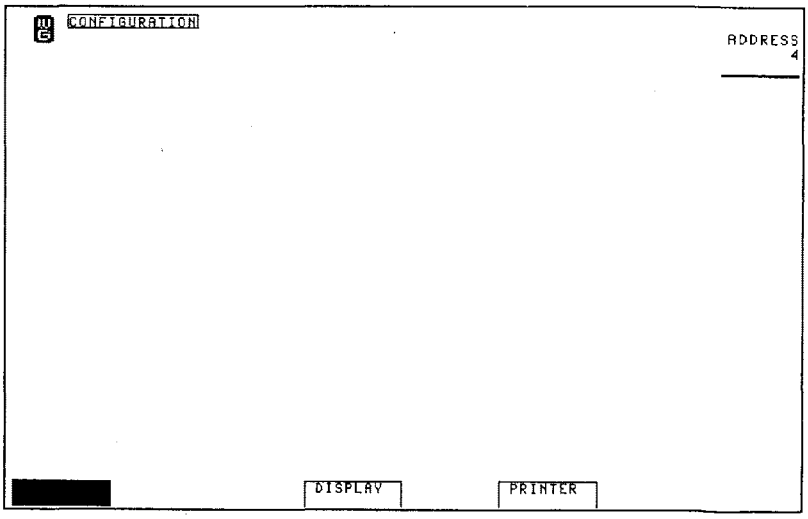


Fig. 6-2 Submenu for setting the device address

Note: Each device address must only be allocated once in an interface system, and the controller address must not be used. Certain devices with particular addresses are often linked by specific attributes (e.g. printers with address 30).

6.2.3 Interface functions

Fig. 6-3 below summarizes the interface functions of the SNA. They conform to the IEC 625.1 and IEEE 488.1 standards.

Functions	IEEE 488.1	IEEE 488.2 Chapter
Source Handshake	SH1	5.1.1
Acceptor Handshake	AH1	5.1.2
Talker	T6	5.3
Listener	L4	5.4
Service Request	SR1	5.5
Remote/Local	RL1	5.6
Parallel Poll	PP1	5.7
Device Clear	DC1	5.8
Device Trigger	DT1	5.9
Driver/Receiver Ports	E2	5.11

Fig. 6-3 Interface functions

6.3 Status report system

6.3.1 Structure (overview)

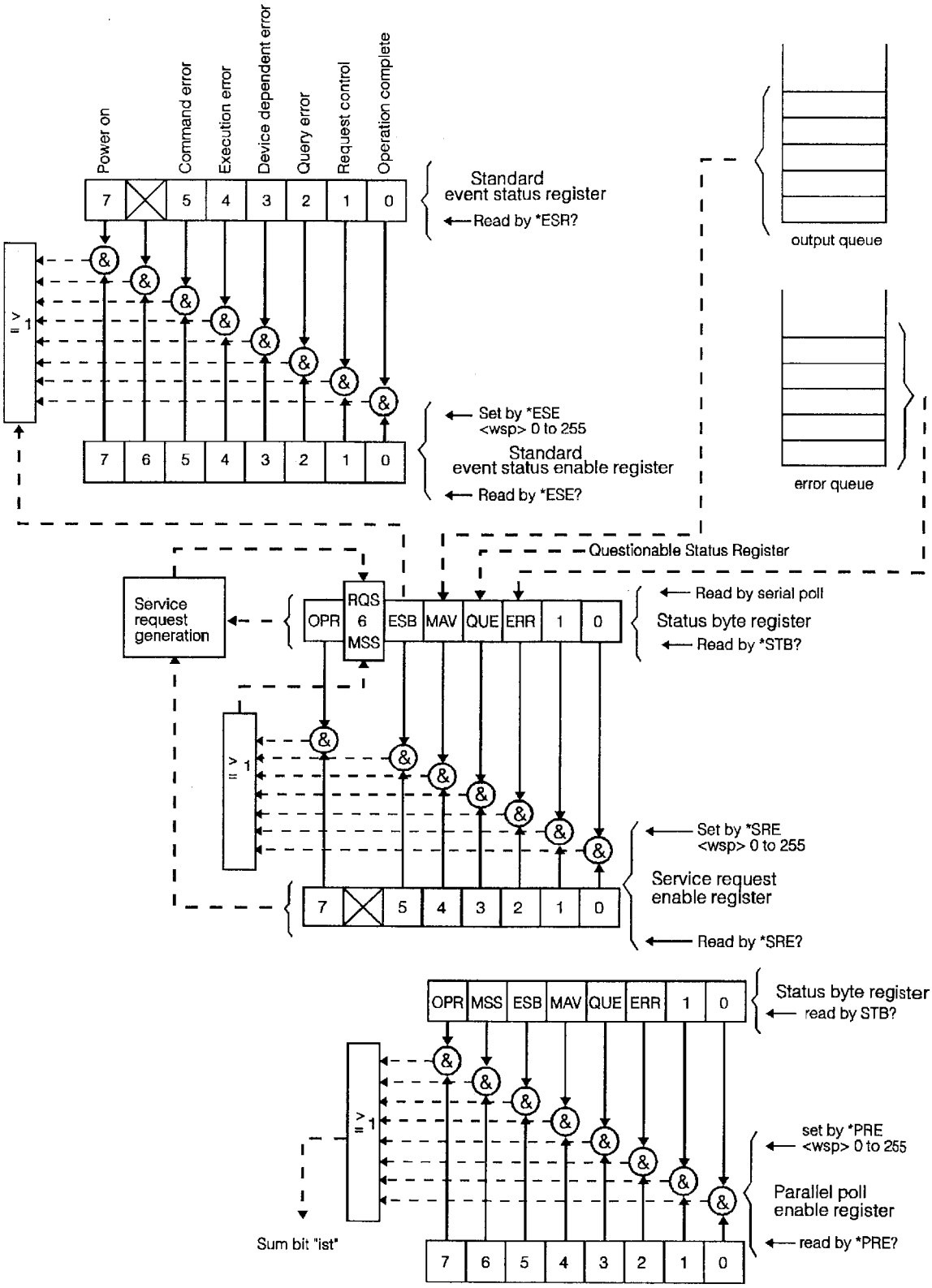


Fig. 6-4 Structure of the status report system

6.3.2 Status byte register STB

Programming word

The status byte register contains the sum message of the event status registers, the output queue and the RQS or MSS message; see Fig. 6-5.

Bit assignment

Bit no. (value)	Meaning
2 (4)	ERR: Error queue bit This indicates the sum message of the error queue. The ERR bit is true if there is an error message in the error queue.
3 (8)	QUE: Questionable Status bit This indicates the sum message of the questionable status register system if abnormal operating conditions prevail.
4 (16)	MAV: Message available bit This indicates the sum message of the output queue. The MAV bit is true if the device has made data available for polling in the output queue.
5 (32)	ESB: Event status bit This indicates the sum message of the linked event registers (standard event status register and standard event status enable register).
6 (64)	RQS: Request service bit The RQS bit changes to "1" if the sum message of the STB register and the SRE register has initiated a service request. The bit is reset by a SERIAL POLL - together with the SRQ message. MSS: Master summary status bit The MSS bit changes to "1" if the sum message of the STB register and the SRE register has initiated a service request. The bit is not reset by a poll with *STB? - the SRQ message thus also remains set.
7 (128)	OPR: Operational status bit This indicates the sum message of the operational status register system under normal operating conditions.

Read the register

SERIAL POLL

The status byte information of a serial poll includes the RQS bit. The RQS bit is reset after the serial poll (RQS ≡ SRQ).

STB?

The status byte information of a poll with the *STB? command includes the MSS bit. The bit is not reset after the poll.

Clear the register The contents of the register can be cleared with the common *CLS command. The command has no effect on the MAV bit, however.

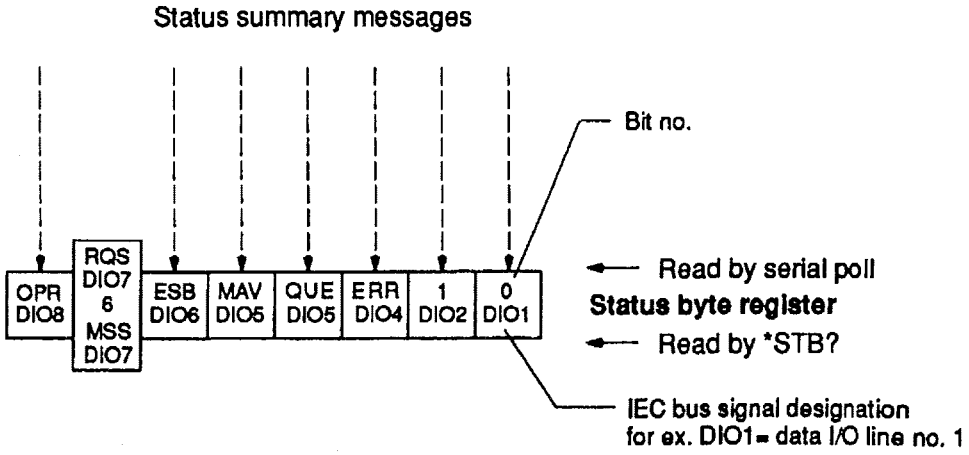


Fig. 6-5 Structure of the status byte register

6.3.3 Service request enable register SRE

Programming word The status byte register must be masked with the service request enable register, in order to define which sum message initiates a service request; see Fig. 6-6.

Define the register The contents of the register can be defined with the common *SRE <decimal-no.> command.

Bit no.	Meaning	Decimal no.
7	OPR bit	128
6	Not available	(64)
5	ESB bit	32
4	MAV bit	16
3	QUE bit	8
2	ERR bit	4
1	Not used	(2)
0	Not used	(1)

Read the register The contents of the register can be read with the common *SRE? command. The result is a decimal number in the range from 0 to 255.

Clear the register The contents of the register can be cleared with the common *SRE 0 command.

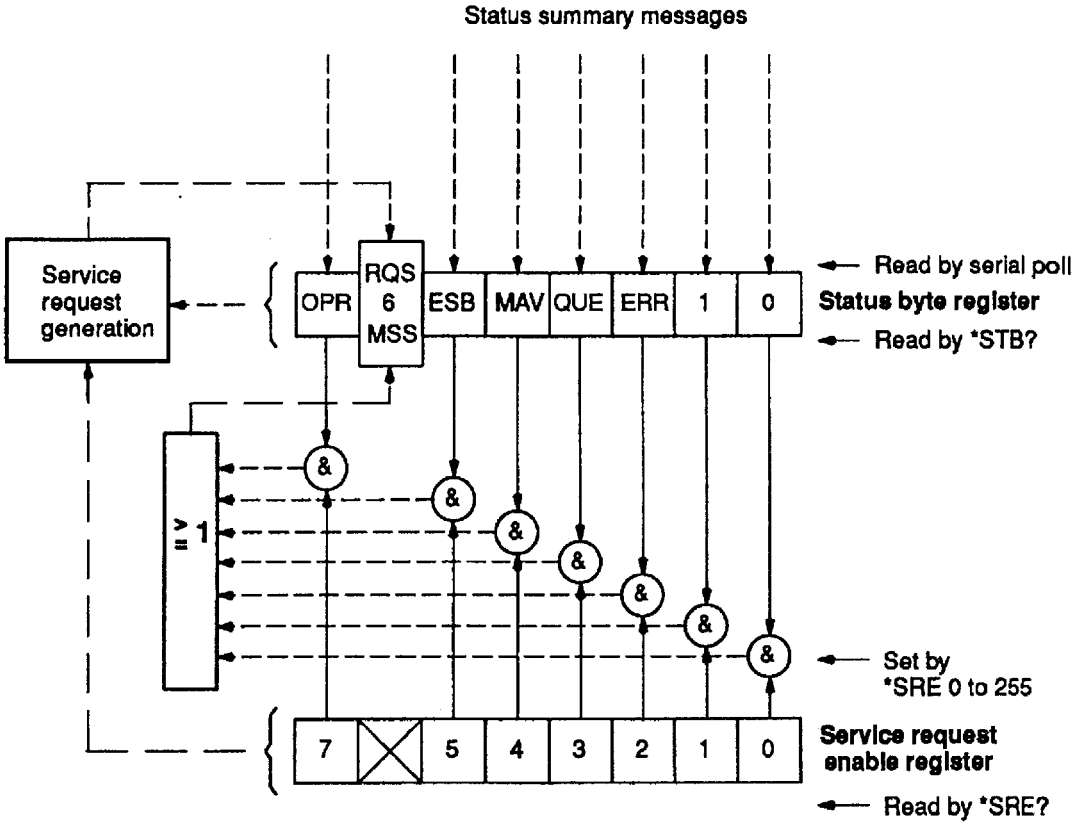


Fig. 6-6 Service request

6.3.4 Standard event status register ESR

Programming word

The standard event status register contains the device states defined by the IEEE 488.2 standard (see bit assignment).

Bit assignment

Bit no. (value)	Meaning
0 (1)	OPC Operation complete. The bit is set after the device has executed an instruction and is ready to accept new instructions, providing *OPC has been programmed beforehand.
1 (2)	RQC Request Control = The bit indicates to the controller that the device wishes to be an active controller temporarily (e.g. to drive a plotter).
2 (4)	QYE Query error. The bit is set if: - An attempt has been made to read the contents of the output queue, but the queue is empty or - The contents of the output queue have been lost, e.g. due to a queue overflow.
3 (8)	DDE Device-dependent error. Example: The bit is set if a programming instruction cannot be executed as a result of a device status. It indicates that the error is not a command, query or execution error.
4 (16)	EXE Execution error (parameter error). The bit is set, for example, if the parameter value of an instruction is outside the permissible setting range of the device.
5 (32)	CME Command error (unknown command). A command error is caused by the following events: Syntax error Semantic error
7 (128)	PON Power on. The bit is set after the device is switched on or after it starts up again following a power failure.

Read the register

The contents of the register can be read with the common *ESR? command. The result is a decimal number in the range from 0 to 255. Reading the register causes its contents to be cleared.

Clear the register

The contents of the register can be cleared with the common *CLS and *ESR? commands.

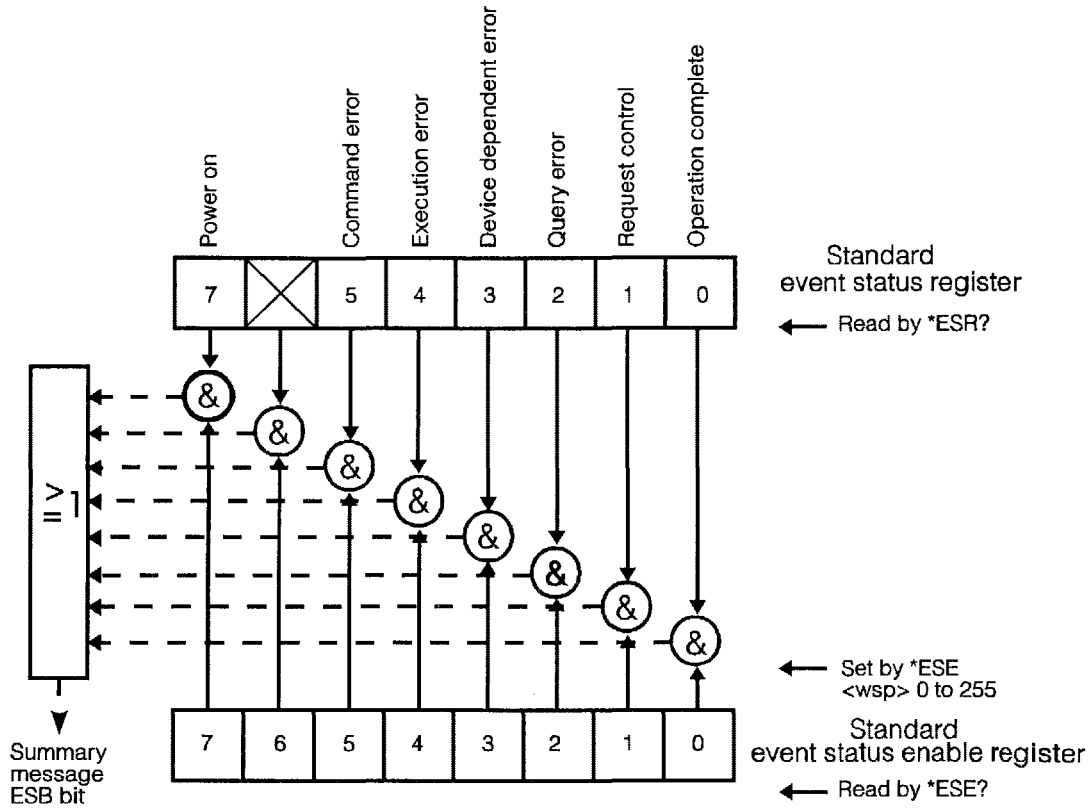


Fig. 6-7 Structure of the standard event register

6.3.5 Standard event status enable register ESE

Programming word

The standard event status enable register can be used to mask the standard event status register, in order to define which device states form the sum message (ESB bit) for the status byte register, see Fig. 6-7.

Define the register

The contents of the register can be defined with the common *ESE <decimal-no.> command. The decimal number must be in the range from 0 to 255.

Bit no.	Meaning	Decimal no.
0	Operation complete	1
1	Request control	2
2	Query error	4
3	Device-dependent error	8
4	Execution error	16
5	Command error	32
6	Not used	(64)
7	Power on	128

Read the register The contents of the register can be read with the common *ESE? command. The result must be in the range from 0 to 255.

Clear the register The contents of the register can either be cleared with the common *ESE 0 command or overwritten with another decimal number.

6.3.6 Output queue

Programming word The output queue is used to buffer the device response messages until they are read by the controller; see Fig. 6-8. If the output queue contains data, the MAV bit in the status byte is set. The only way to write data into the output queue is through queries (..?).

Note: A time limit (TIMEOUT) should be set for the output queue to be read after an SRQ is initiated, since the fact that the MAV bit is set does not necessarily mean that the queue actually contains any data. The output queue may have been cleared as a result of a query error, for example (see ANSI/IEEE Std 488.2 - 1987, Chapter 6.3.2.3, Page 51). If a TIMEOUT occurs, its cause can be established by reading the standard event status register.

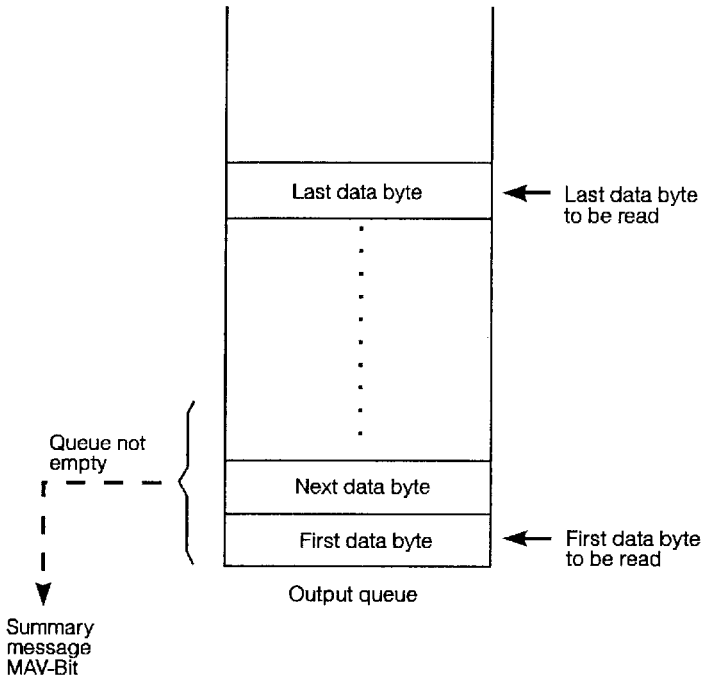


Fig. 6-8Standard output queue

6.3.7 Parallel poll

Programming word

The SNA has a parallel poll function as well as a serial poll one. This interface function (PP 1) conforms to the IEEE 488.2 standard.

The primary PPC command (parallel poll configure) is used to configure the SNA for a parallel poll. The data line on which the device is to respond is then assigned with the secondary PPE command (parallel poll enable).

PRE register

The status byte register can be masked with the parallel poll enable register.

Define the register

The contents of the register can be defined with the common *PRE <decimal-no.> command. The decimal number must be in the range from 0 to 65535.

Clear the register

*PRE 0 clears the contents of the register. They can also be overwritten by entering another decimal number.

Read the register

The contents of the register can be read with the common *PRE? command. The result is a decimal number in the range from 0 to 65535. (Bits 8 to 15 are not used.)

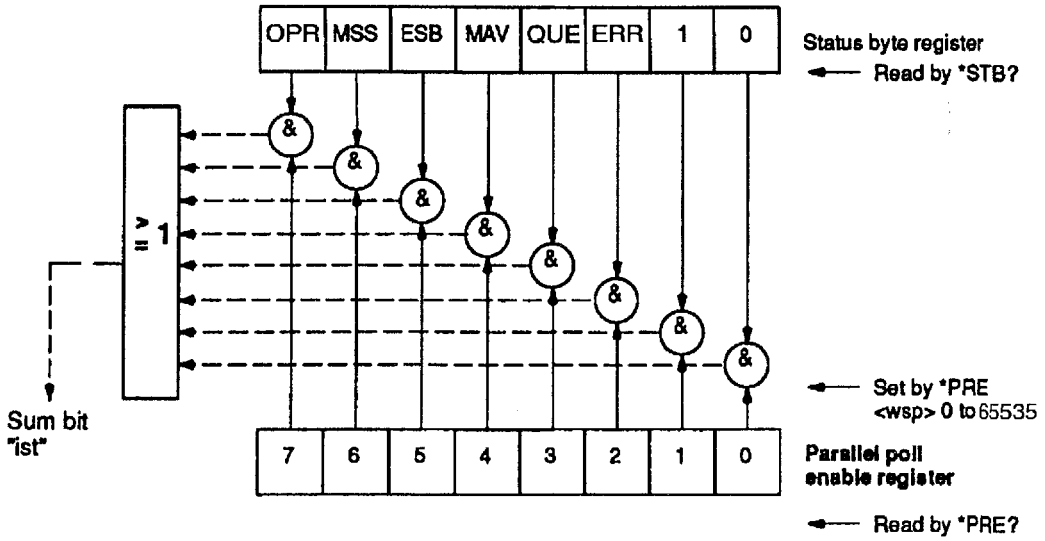


Fig. 6-9 Structure of the parallel poll register

Poll sum bit

The internal device message (status bit: "ist") can be polled with the common *IST? command, without initiating a parallel poll.

6.3.8 Initializing the SNA

The contents of the standard event status register and the status byte register may cause an SRQ to be initiated during the initialization process with *RST and *CLS, as a result of the instrument setups. The control computer must therefore not be enabled for processing SRQs (SRQ enable) until after the initialization routine has finished.

6.3.9 Extended SCPI status report system

General

The status report system is responsible for management of all SNA states in accordance with IEEE 488.2, Chapter 11. A special status register management facility with the following enhancements makes this task easier:

- *Operation* status register system

with the summary bit 7 in the status byte

- *Questionable* status register system

with the summary bit 3 in the status byte

Register components

The operation and questionable status groups have the register components, see Fig. 6-10. An SCPI status register basically consists of two status registers, namely CONDition and EVENT, whereby the COND register contains the current device status. The EVENT register saves this status as a non-recurring event dependent on the transition registers.

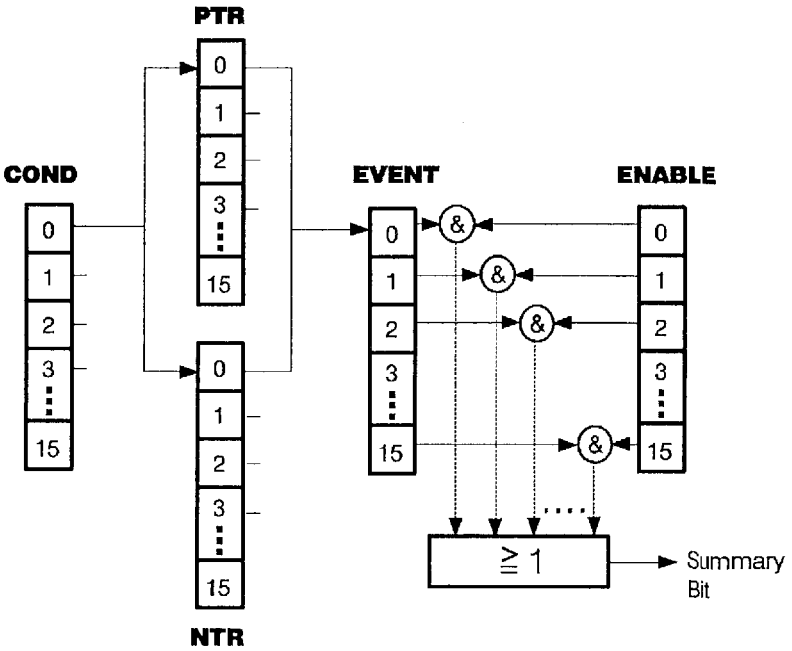


Fig. 6-10 Principle of status polling; &: logical AND, ≥1: logical OR

COND

Condition register: Contains the current device status. The status does not change as a result of reading the register.

PTR

Positive transition filter: Defines a positive edge for saving in the EVENT register. (A "0 --> 1" transition in the COND register generates a 1 in the EVENT register if the corresponding PTR bit is 1.)

NTR

Negative transition filter: Defines a negative edge for saving in the EVENT register. (A "1 --> 0" transition in the COND register generates a 1 in the EVENT register if the corresponding NTR bit is 1).

EVENT

Event register: Saves the contents of the condition register until a poll takes place (:STAT:OPER:EVEN? or :STAT:QUES:EVEN?).

ENABLE

Enable register: Contains the mask for the event register and is used as a switch for masking the contents of the event register in the status byte register. Each status node (other than the node of the status byte itself) has its own 16-bit wide condition, event and enable registers and transition filters, see Fig. 6-10. Some of the register components have been omitted from Fig. 6-11 for the sake of simplicity.

Operation register commands

Reset all SCPI registers

```
STATus
      :PRESet
```

Operational states

```
STATus
    :OPERation
        ENABle <NR1>
        ENABle?
        EVENt?
        NTRansition <NR1>
        NTRansition?
        PTRansition <NR1>
        PTRansition?
```

Questionable register commands

Status queries regarding

```
STATus
    :QUEStionable
        CONDition?
        ENABle <NR1>
        ENABle?
        EVENt?
        NTRansition <NR1>
        NTRansition?
        PTRansition <NR1>
        PTRansition?
```

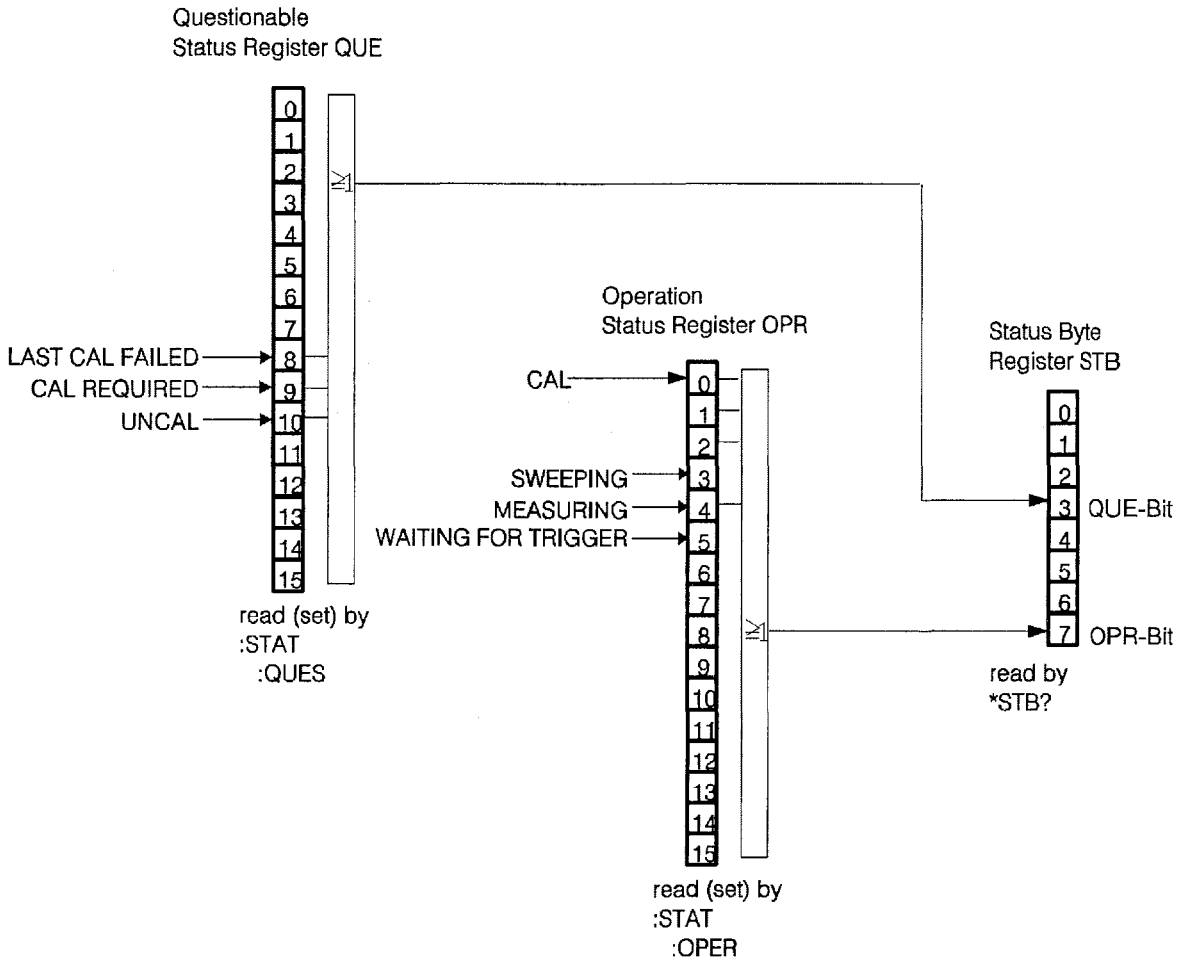


Fig. 6-11 Extended SCPI status report system

6.3.9.1 Operation status

The operational status register is responsible for management of the states which occur during normal operation of the instrument; see Fig. 6-11.

6.3.9.2 Questionable status

Questionable status registers contain bits that provide information about the quality of the most recently established measured values or parameters. They can be polled if desired. If a bit is set, the results or parameters must be outside the specified limits; see Fig. 6-11.

6.3.9.3 Initializing the extended SCPI status management system

General SCPI/IEEE 488.2 rules

Initialization to SCPI and IEEE 488.2

	SCPI Trans. Filter	SCPI Enable Register	SCPI Event Register	SCPI Error Queue	488.2 Register ESE, SRE	488.2 Register SESR, STB
*RST	none	none	none	none	none	none
*CLS	none	none	clear	clear	none	clear
power-on	preset#	preset#	clear#	clear#	clear#	clear#
STATUS :PRESET	preset	preset	none	none	none	none

#: If the power-on status clear flag is true.

Register initialization; STATus:PRESet

Register	Filter/enable	Preset value =
OPERation	ENABle PTR NTR	0's 1's 0's
QUEStionable	ENABle PTR NTR	0's 1's 0's

6.4 Syntax

General

A fixed syntax must be observed in order for external controllers and the SNA to be able to understand one another when they exchange device messages. This syntax is defined in IEEE 488.2 and explained below.

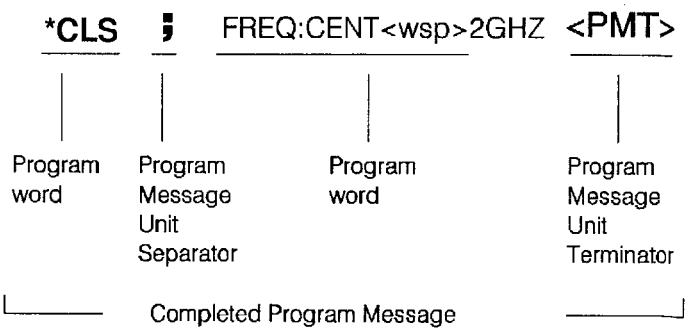
A distinction is made between the talker syntax and the listener syntax. The two basic principles are precision when talking and tolerance when listening.

Program message

The listener syntax applies when a message is sent from the controller to the instrument (program message). A program message comprises the following components:

1. Program message unit(s)
   The program message unit is the programming word which sets the instrument. A distinction is made between the command message unit and the query message unit. The command message unit causes the instrument to be set, while the query message unit causes the instrument to make data available for output.
2. Program message unit separator(s)
   The program message unit separator separates a string of command or query message units within a program message.
3. Program message terminator (PMT)
   The program message terminator indicates the end of a program message: either the EOI line is activated at the end of a data transfer (^END) and a line feed character is transmitted in the data stream (NL = LF ASCII character).

Example

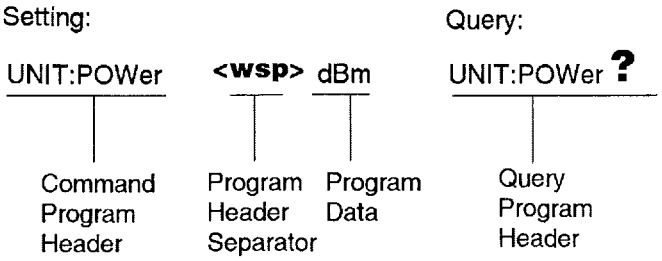


Programming word

A programming word (command or query message) comprises the following components:

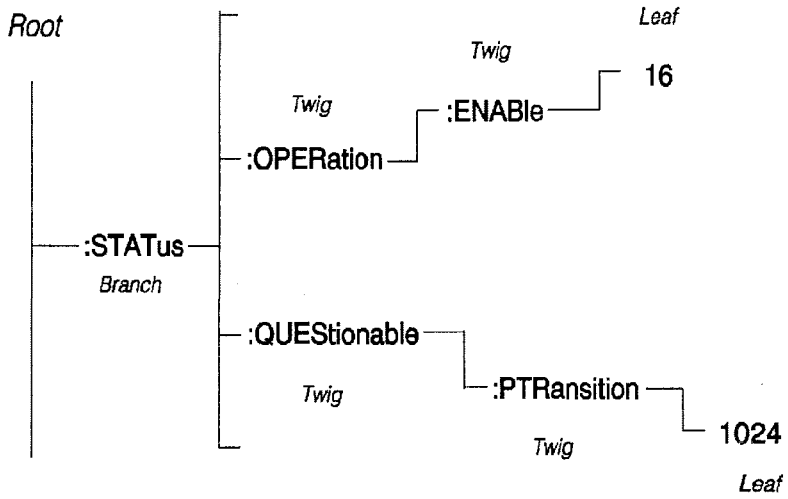
1. Command or query program header
2. Program header separator <white space>
3. Program data (parameters)

Examples



Tree structure

The SNA is programmed with programming words in a tree structure. The components of the programming words are similar to those of a tree in nature.



Input

The device-specific programming words are shown here in their long forms (i.e. including redundant characters), to make them more easily identifiable. The characters which are mandatory for programming are shown in capital letters. When the programming words are entered, either upper or lower-case letters may be used; see also SCPI Vol. 1, Chapter 6.

Program data

Various types of program data are used to enter parameter values in the SNA:

Character program data

For entering parameters which require an alphanumeric expression, e.g. activation of an operating mode; see also IEEE 488.2, 7.7.1. The character program data of the SNA is generally based on the menu designations used in manual mode, e.g. **ON** (parameter of `CAL:AUTO`).

SCPI also allows numeric values to be set using character program data, providing the parameter values are defined ones.

MINimum corresponds to the minimum value of the parameter

MAXimum corresponds to the maximum value of the parameter
DEFault corresponds to the default value of the parameter

Note: The character program data may be entered in the SNA in either the short or long form.

Decimal numeric program data

For entering numerical parameter values in the SNA; see also IEEE 488.2, 7.7.2. Decimal numeric program data can be entered in various ways, as shown by the example below with a center frequency of 10 GHz:

1. As an integer number <NR1>

10000000000

2. As a floating-point number without an exponent <NR2>

10000000000.0

3. As a floating-point number with an exponent <NR3>

1.E+10

The input must always refer to the basic unit (in this case Hz).

Suffix program data

Serves as a suffix for defining the unit of decimal numeric program data; see also IEEE 488.2, 7.7.3.

Example: Frequency = 10 MHz

Input: **10MHZ** or **0.01GHZ**, etc.

If a suffix is not used, **1.E7** must be entered instead in this example, since the basic unit is 'Hz'.

String program data

For entering texts, e.g. setup titles; see also IEEE 488.2, 7.7.5.

It should be remembered that string program data must always be enclosed in inverted commas: **"<setup-title>"**.

Boolean

For parameters which always have one of two states (e.g. switch functions).

ON | 1
OFF | 0

All numbers which are not 0 are interpreted as 1 (ON).

Program header separator

The program header separator **<white space>** (blank) separates program data from the command program header; abbreviation: **<wsp>**.

Program data separator

The program data separator **<,>** (comma) separates program data within a program message unit.

Response message

The talker syntax applies when a message is sent from the instrument to the controller (response message). An SNA response message comprises the following components:

1. Response message unit(s)
2. Response message terminator <RMT>

The response message terminator indicates the end of a response message (line feed character); see also IEEE 488.2, 8.3 (terminated response messages).

Response data

Various types of response data are used to output parameter values and for general queries:

Character response data

In response to queries concerning parameters containing alphanumeric expressions; see also IEEE 488.2, 8.7.1. The short form is always used in the output.

Numeric response data

In response to normal parameter queries; see also IEEE 488.2, 8.7.2 ... 4. A suffix is **not** sent with the numeric response data. The same distinction is made as with decimal numeric data:

<NR1> Integer numbers

<NR2> Floating-point numbers without an exponent

<NR3> Floating-point numbers with an exponent

It should be noted that numeric data must always refer to a fixed basic unit.

0/1

In response to parameter queries (concerning Boolean programming data) for which there are only two possible states; output either **0** or **1**.

String response data

In response to parameter queries (concerning *String program data*); see also IEEE 488.2, 8.7.8.

Arbitrary ASCII response data

In response to queries concerning, for example, the device version, when alphanumeric character blocks of different lengths must be sent (7-bit ASCII code); see also IEEE 488.2, 8.7.11.

Arbitrary block response data

Used to output large volumes of data in 8-bit ASCII code with a fixed block length; see also IEEE 488.2, 8.7.9.

6.5 Common commands

This section describes the common commands in alphabetical order.

*CLS

Meaning

*CLS clears all status data structures and forces the:

1. Operation complete command idle state
2. Operation complete query idle state

If *CLS occurs directly after a program message terminator:

1. The output queue and
2. Possibly the MAV bit are erased.
3. The error queue is erased
4. Possibly the ERR bit in the status byte is cleared.

See also section 6.3.9.3

Programming word

Setup ***CLS**

*ESE/*ESE?

Meaning

The *ESE command can be used to define the contents of the standard event status enable register.

The *ESE? command can be used to query the contents of the standard event status enable register.

Range of the decimal number: 0 to 255

Bit no.	Meaning	Decimal no.
0	Operation complete	1
1	Request Control	2
2	Query error	4
3	Device-dependent error	8
4	Execution error (parameter error)	16
5	Command error (unknown command)	32
6	Not used	(64)
7	Power on	128

Programming word

Setup ***ESE<wsp>0 ... 255**

Query ***ESE?**

Response <NR1>

*ESR?

Meaning

*ESR? can be used to read the contents of the standard event status register. The register contents are cleared at the same time.

The meanings of the decimal number are shown in the table below.

Bit no.	Meaning	Decimal no.
0	Operation complete	1
1	Request Control	2
2	Query error	4
3	Device-dependent error	8
4	Execution error (parameter error)	16
5	Command error (unknown command)	32
6	Not used	(64)
7	Power on	128

Programming word

Query ***ESR?**

Response <NR1>

*IDN?

Meaning

*IDN? can be used to identify the device. The response takes the form of fields containing the device data and separated by commas:

Field 1 Company name

Field 2 Model

Field 3 Serial number

Field 4 Firmware level

Programming word

Query ***IDN?**

Response <Arbitrary ASCII response data>

Example:

```
WANDEL & GOLTERMANN, SNA-23, A0061, 1.00
```

*IST?

Meaning

*IST? can be used to query the sum bit ("ist") without initiating a parallel poll.

0 = "ist" false
1 = "ist" true

Programming word

Query	***IST?**
Response	<NR1>

*OPC/*OPC?

Meaning

*OPC sets bit 0 of the standard event status register after all the preceding programming instructions, setups and internal procedures have been completed.

*OPC? writes the ASCII character "1" in the output queue after all the preceding programming instructions, setups and internal procedures have been executed. Bit 0 of the standard event status register is not modified resp. no "1" has been written in the output queue.

Note: This bit is not set for a continuous sweep.

Programming word

Setup	***OPC**
Query	***OPC?**
Response	<NR1>

Related command

common command ***WAI**

*OPT?

Meaning

Use *OPT? to detect options which are installed. It must always be the last program message unit in a program message.

Programming word

Query	***OPT?**
Response	<Arbitrary ASCII Response Data>
Example:	**1** TG connected
	0 No TG connected

*PCB

Meaning

*PCB is used to pass the address of the system controller. The SNA returns control back to this address (e.g. when a printout via the IEEE bus is complete).

Programming word

Setting ***PCB <wsp>0 ... 30**

*PRE/*PRE?

Meaning

*PRE can be used to define the contents of the parallel poll enable register.

*PRE? can be used to read the current contents of the parallel poll enable register.

Range of the decimal number: 0 to 65535

Bit no.	Meaning	Decimal no.
0	Not used	1
1	Not used	2
2	ERR enable bit	4
3	QUE enable bit	8
4	MAV enable bit	16
5	ESB enable bit	32
6	MSS enable bit	64
7	OPR enable bit	128

Bits no. 8 to 15 not used

Programming word

Setup ***PRE<wsp>0 ... 65535**

Query ***PRE?**

Response <NR1>

*RST

Programming word

*RST can be used to initialize the SNA. The initial setups are restored; see also section 3.6.1.

The initialization procedure has no effect on:

- The interface status
- The device address
- The output queue
- The standard status enable register
- The standard event status enable register

Programming word

Setting ***RST**

*SRE/*SRE?

Meaning

*SRE can be used to define the contents of the service request enable register.

*SRE? can be used to read the contents of the service request enable register.

Valid range of the decimal number: 0 to 255

(Meaningful range: 0 to 191)

Bit no.	Meaning	Decimal no.
0	Not used	(1)
1	Not used	(2)
2	ERR bit	4
3	QUE bit	8
4	MAV bit	16
5	ESB bit	32
6	Not available	(0)
7	OPR bit	128

Programming word

Setup ***SRE<wsp>0 ... 255**

Query ***SRE?**

Response <NR1>

*STB?

Programming word

*STB? can be used to read the contents of the status byte register. The register contents are not modified.

Range 0 to 255.

Bit no.	Meaning	Decimal no.
7	OPR bit	128
6	MSS bit	64
5	ESB bit	32
4	MAV bit	16
3	QUE bit	8
2	ERR bit	4
1	Not used	(2)
0	Not used	(1)

Programming word

Query ***STB?**

Response <NR1>

*TRG

Meaning

This trigger command has the same function as the Group Execute Trigger command from 488.1.
*TRG, like Group Execute Trigger, affects the trigger source in the trigger system.

Programming word

Setting ***TRG**

*TST?

Programming word

*TST? can be used to run an SNA self-test.

Programming word

Query ***TST?**
Response <NR1>

<NR1> = **0**: Test successful (OK)
<NR1> = **not 0**: Test unsuccessful (FAILED)

*WAI

Meaning

With *WAI the following program message unit is not executed until the current program message unit, all previous settings and internal processes are terminated (synchronization command).

Note: When Continuous Sweep is set, *WAI blocks all further commands.

Programming word

Setup ***WAI**

Related command

common command ***OPC, *OPC?**

6.6 Tree structure of the device-dependent programming words (device commands)

6.6.1 General

Meanings of the data types:

NV_char:	MINimum MAXimum | DEFault | UP | DOWN
NV_Freq:	Numeric value with or without a unit (valid units: HZ | KHZ | MHZ | MAHZ | GHZ)
NV_Time:	Numeric value with or without a unit (valid units: MS | MSEC | KS | KSEC)
NV_Level:	Numeric value with or without a unit (valid unit: DB)
NV_RefLev:	Numeric value with or without a unit (valid units: none so far, interpreted as a value in the current unit)
NV_Hex:	Numeric value which can also be entered as a non-decimal numeric value in hex (#H) (without a unit)
NV:	Numeric value without a unit
Boolean:	ON | OFF or 0 | 1

The numeric value can be <NR1>, <NR2> or <NR3> for PROGRAM DATA.
It is always <NR3> for RESPONSE DATA.

Meanings of the remarks:

nq	No query possible (because it is an event)
qo	Query only (this is the only possible form)

6.6.2 Tree structure

CALCulate

: LIMit			
: : LOWer			
: : : VALue	<NV_Freq,NV_RefLev>	DISPLAY/TOLMASK/TOLMASK-EDIT	nq
: : : AVALues?	<NV_Freq,NV_RefLev>,..	Query of the tol. mask points	qo
: : : POINts?	<NV>	Number of points	qo
: : : STATe	<Boolean>	DISPLAY/TOLMASK/TOLMASK-EVAL	
: : : CLEar		DISPLAY/TOLMASK/DELETE ALL	nq
: : UPPer			
: : : VALue	<NV_Freq,NV_RefLev>	DISPLAY/TOLMASK/TOLMASK-EDIT	nq
: : : AVALues?	<NV_Freq,NV_RefLev>,..	Query of the tol. mask points	qo
: : : POINts?	<NV>	Number of points	qo
: : : STATe	<Boolean>	DISPLAY/TOLMASK/TOLMASK-EVAL	
: : : CLEar		DISPLAY/TOLMASK/DELETE ALL	nq

CALibration

: ALL?			qo
: AUTO	<Boolean>	CAL/AUTO	
: SOURce	IF | EXTernal | INTernal	CAL/EXECUTE xxx-CAL (presetting only)	
: VALue			
: : FREQuency	<NV_Freq | NV_char>	CAL/USER SOUREC/FREQ	
: : LEVel	<NV_RefLev | NV_char>	CAL/USER SOURCE/LEVL	
: CLEar		CAL/CLEAR EXT CAL CORRECTION	nq

DISPlay

: ANNotation			
: : TITLe			
: : : SOURce	STD | USER	DISPLAY/USER TITLE/TITLE	
: : : TITLe	<String>	DISPLAY/USER TITLE/TITLE	
: : LOGO	<Boolean>	DISPLAY/USER TITLE/LOGO	
: GRATicule	ON | HLINes | VLINes | OFF	DISPLAY/GRATICULE	
: TMEMory			
: : ARGument	A | B | AB | A_B	TRACE/TRACE MEMORY/TRACE	
: : COPY	ATOB	TRACE/TRACE MEMORY/STORE A -> B	nq
: : ZPOSition	MIDDle | TOP	TRACE/TRACE MEMORY/A-B ZPOS	
: TMASk			
: : STATe	<Boolean>	DISPLAY/TOLMASK/TOLMASK	
: X			
: : STEP			
: : : ARGument	<NV_Freq|MIN|MAX|DEF>	DISPLAY/FREQUENCY AXIS/FSTEP	
: : : AUTO	<Boolean> | ONCE	DISPLAY/FREQUENCY AXIS/FSTEP AUTO	
: : MODE	SSTop | CSPan | SSPan	DISPLAY/FREQUENCY AXIS/FSCALE	
: Y			
: : SCALe	<NV_Level | NV_char>	SCALE	
: : STEP			
: : : ARGument	<NV_Level | MIN | MAX | DEF>	DISPLAY/ LEVEL AXIS/LSTEP	
: : : AUTO	<Boolean> | ONCE	DISPLAY/LEVEL AXIS/LSTEP AUTO	
: : SPACing	LINiear | LOGarithmic	DISPLAY/LEVEL AXIS/MEAS SCALE	
: : MODE	ABSolute | RELative	DISPLAY/LEVEL AXIS/SCALE	

FORMat			
: DATA	ASCii | INTeger | REAL		
: BORDer	NORMal | SWAPped		
HCopy			
: DESTination	<data_handle>	CONFIGURATION/HARDCOPY/DESTINAT.	
	"SYST:COMM:GPIB" |	IEEE bus	
	"SYST:COMM:SER" |	Serial interface	
	"SYST:COMM:CENT"	Parallel interface	
: DEVice			
: : LANGuage	ESCP9|ESCP24|PCL2| PCL3|HPGL	CONFIGURATION/HARDCOPY/DEVICE	
: SDUMp			
: : IMMediate		Hardcopy key	nq
INPut	**(not in mode EXT.MIXER - INST:TYPE EMIXer)**		
: ATTenuation			
: : ARGument	<NV_Level | NV_char>	ATTN	
: : AUTO	<Boolean> | ONCE	ATTN AUTO	
: GAIN			
: : ARGument	<NV_Level | NV_char>	EXTERN ATTN	
: : IMPedance	<NV_Ohm | NV_char>	EXTERN IMP	
INSTrument			
: TYPE	CW | EMIXer	MODE menu	
MMEMory			
: MSIS	<String> (A: | B: | C:)	USER MEMORY/USER MEMORY/DEVICE	
: LOAD			
: : SET	<NV>	USER MEMORY/RECALL	nq
: STORe			
: : SET	<NV>	USER MEMORY/SAVE	nq
: DELete			
: : SET	<NV>	USER MEMORY/DELETE	
OUTPut	**For the TG only**		
: STATe	<Boolean>	GENERATOR/GENERATOR on/off	
: ATTenuation			
: : ARGument	<NV_Level>|<NV_char>	GENERATOR/EXT.ALC/STEP ATTN	
: : AUTO	<Boolean>	GENERATOR/EXT.ALC/STEP ATTN AUTO	
: GAIN			
: : ARGument	<NV_Level>|<NV_char>	GENERATOR/EXT. ATTN	
: : IMPedance	<NV_Ohm>|<NV_char>	GENERATOR/EXT. IMP	
	Sense Subsystem		
AVERage			
: STATe	<Boolean>		
: TYPE	SCALar | MAXimum | MINimum	TRACE/TRACE PROCESS/TRACE	
: COUNt	<NV | NV_char>	TRACE/TRACE PROCESS/AVERAGE WEIGHTING	

BANDwidth | BWIDth

: RESolution			
: : ARGument	<NV_Freq | NV_char>	RBW	
: : AUTO	<Boolean> | ONCE	RBW AUTO	
: VIDeo			
: : ARGument	<NV_Freq | NV_char>	VBW	
: : AUTO	<Boolean> | ONCE	VBW AUTO	

DETector

: FUNCtion	NORMal | POS | NEG | PNEG | SAMPle | PSAMple	TRACE/TRACE DETECT/DETECT	

DEModulator

: MODulation	AM | FM | TONE	AUXILIARY/DEMOD/DEMOD	
: MODE	CONT | MARKer | OFF	AUXILIARY/DEMOD/MODE	
: DTIMe	<NV_Time | NV_char>	AUXILIARY/DEMOD/DWELLTIME	
: VOLume			
: : SPEaker	<NV | NV_char>	AUXILIARY/DEMOD/VOLUME SPEAK	
: : EARPhone	<NV | NV_char>	AUXILIARY/DEMOD/VOLUME EARPH	

FREQuency

: CENTer	<NV_Freq | NV_char>	FCENT	
: SPAN	<NV_Freq | NV_char>	FSPAN	
: STARt	<NV_Freq | NV_char>	FSTART	
: STOP	<NV_Freq | NV_char>	FSTOP	
: COUNter			
: : STATe	<Boolean>	AUXILIARY/FREQUENCY COUNTER/COUNTER	
: : SOURce	CARRier | VIDeo | TINPut	AUXILIARY/FREQUENCY COUNTER/SOURCE	
: : RESolution	<NV_Freq | NV_char>	AUXILIARY/FREQUENCY COUNTER/RESOLUTION	
: : THReshold	<NV_RefLev | NV_char>	AUXILIARY/FREQUENCY COUNTER/VID THRESH	
: : VALue?		AUXILIARY/FREQUENCY COUNTER/Result	qo
: MANual			
: : ARGument	<NV_Freq | NV_char>	MANUAL	
: : VALue?		Manual result, provides freq. and level	qo

MARKer

: DISPlay	<Boolean>	<MARKER>/MKR DSPL	
: THReshold	<NV_RefLev | NV_char>	MARKER PEAK/PK THRSHLD	
: SARel		MARKER TRANSFER/SWAP ABS<->REL	
: ABSolute			
: : ARGument	<NV_Freq | NV_char>	Frequency entry for the ABS marker	
: : VALue?		Marker result, provides freq. and level	qo
: : FUNCtion	HIGHest | NEXT | RIGHT | LEFT	Peak functions for the ABS marker	nq
: : COPY	CENT | STARt | STOP | STEP | REFerence	Transfer functions for the ABS marker	nq
: : PTRack	<Boolean>	Peak track, ABS marker	
: : CONDition	LIVE | HOLD	Refresh for the ABS marker	
: : READout	MINimum | MAXimum	<MARKER>/DETECT	
: : MEMorize		MARKER/MARKER LABEL/LABEL MKR POS	nq

: RELative			
: : ARGument	<NV_Freq | NV_char>	Frequency entry for the REL marker	
: : VALue?		Marker result, provides freq. and level	qo
: : FUNCtion	HIGHest | NEXT | RIGHt | LEFT	Peak functions for the REL marker	nq
: : COPY	CENT | STARt | STOP | STEP	Transfer functions for the REL marker	nq
: : PTRack	<Boolean>	Peak track, REL marker	
: : CONDition	LIVE | HOLD	Refresh for the REL marker	
: : READout	MINimum | MAXimum	<MARKER>/DETECT	
: : MEMorize		MARKER/MARKER LABEL/LABEL MKR POS	nq
: LABel			
: : MEMorize		MARKER/MARKER LABEL/LABEL ALL PEAKS	nq
: : CLEar		MARKER/MARKER LABEL/CLEAR ALL LABELS	nq
: : DATA?	<NV_Freq,NV_RefLev>,..	Query of all labels	qo
: : POINts?	<NV>	Query of number of labels	qo
: : SORT	FREQuency|LEVel	MARKER/MARKER LABEL/SORT BY	
MIXer	**(only in mode EXT.MIXER - INSTrument:TYPE EMIXer)**		
: FREQuency			
: : MINimum	<NV_Freq>|<NV_char>	MIXER-CONFIG/FMIN	
: : MAXimum	<NV_Freq>|<NV_char>	MIXER-CONFIG/FMAX	
: : BAND	K|A|Q|U|V|E|W|F|D|G|Y|J	MIXER-CONFIG/BAND	
: : SPAN			
: : : FULL		MIXER-CONFIG/FMIN,FMAX -> START,STOP	nq
: HARMonic	<NV>|<NV_char>	MIXER-CONFIG/HARM	
: LOSS	<NV_Level>|<NV_char>	CONV LOSS	
: BIAS	<NV_Current>|<NV_char>	DC-BIAS	
POWer | :VOLTage			
: REFerence	<NV_RefLev | NV_char>	REFERENCE	
SWEep			
: MODE	AUTO | MANUAL	SWEEP/MANUAL keys	
: HOLD	<Boolean>	HOLD key	
: SPACing	LINear | LOGarithmic	DISPLAY/FREQUENCY AXIS/FREQ AXIS	
: TIME			
: : ARGument	<NV_Time | NV_char>	SWT	
: : AUTO	<Boolean> | ONCE	SWT AUTO	
: STRack	<Boolean>	AUXILIARY/SWEEP MODE/SIGNAL TRACK	
SOURce	**For the TG only**		
: FREQuency			
: : OFFSet			
: : : ARGument	<NV_Freq>|<NV_char>	GENERATOR/GEN OFFSET	
: : : STATe	<Boolean>	GENERATOR/GEN OFFSET on/off	
: POWer			
: : LEVel	<NV_RefLev>|<NV_char>	GENERATOR/GEN LEVEL	
: : ALC			
: : : STATe	HOLD|LIVE	GENERATOR/ALC STATE	
: : : SOURce	INTernal|DIODe| PMETer|EPM	GENERATOR/ALC MODE and EXT.ALC/SENSE	
: : : RANGe			
: : : : PMETer	<NV_DBM>|<NV_char>	GENERATOR/EXT.ALC/PWM RANGE	
: : : : DIODe	<NV>|<NV_char>	GENERATOR/EXT.ALC/DETECTOR	

STATus

: PRESet			nq
: OPERation			
: : EVENt?			qo
: : CONDition?			qo
: : ENABle	<NV_Hex>		
: : PTRansition	<NV_Hex>		
: : NTRansition	<NV_Hex>		
: QUEStionable			
: : EVENt?			qo
: : CONDition?			qo
: : ENABle	<NV_Hex>		
: : PTRansition	<NV_Hex>		
: : NTRansition	<NV_Hex>		

SYSTem

: COMMunicate			
: : GPIB			
: : : SELF			
: : : : ADDRess	<NV | NV_char>	CONFIGURATION/IEEE 488/ADDRESS	
: : : RDEVice			
: : : : ADDRess	<NV>|<NV_char>	CONFIGURATION/HARDCOPY/HARDCOPY ADDR	
: ERRor?			qo
: VERSion?			qo

TRACe

: DATA?			qo
: CHANnel	<NV | NV_char>		
: TYPE	CRT | UNIT | DSP		
: DSPRange?			qo

TRIGger

: COUNt	<NV | NV_char>	AUXILIARY/SWEEP MODE/REPAET # TIMES	
: SOURce	IMMediate | EXTernal | LINE | VIDeo | BUS	AUXILIARY/SWEEP TRIGGER/TRIGGER	

INITiate

: IMMediate			nq
: CONTinous	<Boolean>	AUXILIARY/SWEEP MODE/SWEEP	

ABORt		Put trigger system in the IDLE state	nq

UNIT

: POWer|VOLTage	dBm | dB | dBV | dbuV | W | V | dBmHz | dBHz | dBVHz | dbuVHz | WHz | VHz	DISPLAY/LEVEL UNITS	
: RMARker	dB | dBcHz | APCT	MARKER/MARKER UNITS/REL UNIT	

7 Error messages

7 Error messages

7.1 Introduction

Error message system

The SCPI error message system has been used for the SNA. One of its features is the minus sign which precedes the standard error numbers. Positive error numbers refer to device-dependent error messages. The error messages are moreover subdivided into four standard error groups.

If an error occurs, it is recorded in a buffer (max. capacity: 30 errors). When the errors are polled, they are output in the order in which they occurred (FIFO).

Error groups

Command errors

Error number range -100 to -199

The error messages belonging to this number range indicate syntax or semantic errors. Bit 5 (command error) is set in the standard event status register.

Execution errors

Error number range -200 to -299

The error messages belonging to this number range indicate that a syntactically correct command has not been executed due to device-dependent circumstances. Bit 4 (execution error) is set in the standard event status register.

Device-dependent errors

Some of the more general errors belonging to the "device-dependent errors" group are defined in "SCPI" (error numbers -300 to -399). The majority of the errors are however device-dependent and thus not standardized. This is reflected by the positive error number range (0 to 99 for DOS errors and 200 to 299 for device-dependent errors).

The error messages belonging to these number ranges indicate that a device-dependent operation cannot be executed. Bit 3 (device-dependent error) is set in the standard event status register.

Query errors

Error number range -400 to -499

The error messages belonging to this number range indicate that the query/response cycle is incomplete, i.e. the message exchange protocol has been violated.

Error display

If an error occurs in either manual or remote control mode, the corresponding error message is output in clear text on the instrument display. An audible alarm signal is output in addition. The errors are then recorded in a buffer.

Acknowledging error messages

Manual operation

The error message disappears again automatically after approximately 3 s. If more than one error occurs, they are displayed consecutively. "Queue overflow" indicates that more than 5 errors have occurred simultaneously.

Remote control

The `SYSTem:ERRor?` command can be entered to read the error messages in the buffer in the order in which they occurred (FIFO) and to acknowledge them at the same time.

7.2 Command errors -100 to -184

–100 Command error

General syntax error; IEEE 488.2 has not been observed.

–101 Invalid character

The command input contains characters which are not allowed.

–102 Syntax error

The command or parameter value input cannot be identified.

–103 Invalid separator

The programming instruction contains a separator which is not allowed.

–104 Data type error

An invalid parameter or numeric parameter value has been specified.

–105 GET not allowed

A trigger has been attempted during a data transfer.

–108 Parameter not allowed

The number of permissible parameter values has been exceeded in the command input.

–109 Missing parameter

A parameter value has been omitted.

–110 Command header error

The command or query header contains a general error.

–111 Header separator error

The command input contains a separator which is not allowed.

–112 Program mnemonic too long

The command input contains more than 12 characters (see IEEE 488.2, 7.6.1.4.1).

–113 Undefined header

The command or query header input is syntactically correct, but is not available with this device.

–114 Header suffix out of range

The numeric value of the suffix in the command or query header is invalid.

–120 Numeric data error

The numeric parameter value is invalid.

–121 Invalid character in number

A character which is not allowed has been used in a numeric parameter input.

–123 Exponent too large

The magnitude of the exponent of a parameter expressed in exponential form is too high; the maximum permissible value is 32000
(see IEEE 488.2, 7.7.2.4.1).

–124 Too many digits

The mantissa of the decimal number of a parameter input expressed in decimal form contains more than 255 digits.

–128 Numeric data not allowed

The numeric parameter input is syntactically correct, but is not allowed with this device.

–130 Suffix error

The parameter has been specified with an invalid unit.

–131 Invalid suffix

The unit of the parameter is either syntactically incorrect or not meaningful with this device.

–134 Suffix too long

The unit of the parameter contains more than 12 characters.

–138 Suffix not allowed

The parameter value must be entered without a unit.

–140 Character data error

The specified parameter value is invalid.

–141 Invalid character data

The specified parameter either contains characters which are not allowed or is not allowed at all.

–144 Character data too long

The specified parameter contains more than 12 characters.

–148 Character data not allowed

The parameter input is syntactically correct, but is not allowed with this device.

–150 String data error

The specified parameter value is invalid.

–151 Invalid string data

–158 String data not allowed

The parameter input is syntactically correct, but is not allowed with this device.

–160 Block data error

The specified parameter value is invalid.

–161 Invalid block data

–168 Block data not allowed

The parameter input is syntactically correct, but is not allowed with this device.

–170 Expression error

–171 Invalid expression

–178 Expression data not allowed

–180 Macro error

–181 Invalid outside macro definition

–183 Invalid inside macro definition

–184 Macro parameter error

7.3 Execution errors -200 to -286

–200 Execution error

–201 Invalid while in local

–202 Settings lost due to rtl

–210 Trigger error

–211 Trigger ignored

–212 Arm ignored

–213 Init ignored

The INITiate trigger command cannot be executed, as the current measurement is not yet complete.

–214 Trigger deadlock

–215 Arm deadlock

–220 Parameter error

The specified parameter value contains a general error.

–221 Settings conflict

The command input is syntactically correct, but cannot be executed as the current process has not yet been terminated.

–222 Data out of range

The command input is syntactically correct, but cannot be executed as the entered parameter value is outside the specified range of values.

–223 Too much data

–224 Illegal parameter value

The parameter value is syntactically correct, but is not available.

–225 Out of memory

–226 Lists not same length

–230 Data corrupt or stale

Since results have been queried while a measurement is taking place, it may be that the wrong results have been read.

–231 Data questionable

–240 Hardware error

–241 Hardware missing

–251 Missing mass storage

–252 Missing media

–250 Mass storage error

–253 Corrupt media

–254 Media full

–255 Directory full

–256 File name not found

–257 File name error

–258 Media protected

–260 Expression error

–261 Math error in expression

–270 Macro error

–271 Macro syntax error

–272 Macro execution error

–273 Illegal macro label

–274 Macro parameter error

–275 Macro definition too long

–276 Macro recursion error

–277 Macro redefinition not allowed

–278 Macro header not found

–280 Program error

–281 Cannot create program

–282 Illegal program name

–283 Illegal variable name

–284 Program currently running

–285 Program syntax error

–286 Program runtime error

7.4 Device–dependent errors -300 to -350

–300 Device-specific error

–310 System error

–311 Memory error

–312 PUD memory lost

–313 Calibration memory lost

–314 Save/recall memory lost

–315 Configuration memory lost

–330 Self-test failed

The self-test has not been terminated successfully.

–350 Queue overflow

The output queue for error messages is full (max. capacity: 30 error messages). The error which occurred most recently has not been recorded. The "device-dependent error" bit in the standard event status register is set to "1". The error messages can be read with `SYSTem:ERRor?`.

7.5 Query errors -400 to -440

–400 **Query error**

–410 **Query INTERRUPTED**

The device has been accessed repeatedly without waiting for the responses which are still pending.

–420 **Query UNTERMINATED**

An attempt has been made to obtain a response from a device without terminating the query correctly.

–430 **Query DEADLOCK**

More data has been requested with the query than the output queue of the device can hold.

–440 **Query UNTERMINATED after indefinite response**

7.6 Device specific errors

36 **Possible deadlock**

35 **File already exists**

34 **Result too large**

33 **Math argument**

200 **Setup error**

201 **Unknown header in setup**

202 **Header in setup omitted**

203 **Setup is already used**

204 **No setup data**

Notes:

8 Maintenance, service tips and transport

8 Maintenance, service tips and transport

8.1 Maintenance

8.1.1 Instrument configuration

Please specify the instrument data, the instrument model and the software version, in addition to the type designation, in all inquiries or orders for options and accessories.

8.1.1.1 Instrument data

The instrument data comprises the series index and the instrument number. It can be found at the bottom of the front panel underneath the type designation, e.g. **B 0039** means instrument 39 in the B series.

8.1.1.2 Instrument model

You can display the hardware version by opening the CONFIGURATION menu and pressing [SF1]. The box in the center of the display contains the following information:

RF SECTION: WS 65/5 - 26.5 GHz

IF measuring section: FM batch 2

When making technical enquiries, please provide this data on the RF and IF sections.

8.1.1.3 Software version

You can display the software version by opening the CONFIGURATION menu. The box in the center of the display contains the following information:

RELEASE: 2.4 DATE: 94-04-22

The software version is 0.13A and the creation date is August 20th 1993.

PRODUCT: spec CHECKSUM: 0 test 0

The instrument is a spectrum analyzer and the software checksum is 0 test 0.

8.1.2 Cleaning the instrument

Never use a solvent to clean the front panel or the instrument cover!

- Solvents (e.g. petrol or methylated spirit) may dissolve the inscriptions or reduce the sharpness of their contours.
- Cleaning agents designed for plastic surfaces and furniture often have a polishing effect. They may damage the inscriptions or leave shiny marks on the cover plate.

It is advisable to clean the instrument using warm water, to which a little detergent has been added. The cloth which is used should be damp rather than wet. Never allow water to drip inside the instrument. Wipe any parts of the instrument which are still damp with a dry cloth, to prevent staining or marking.

8.1.3 Replacing the fuse

If the instrument does not respond at all when switched on, although the power supply to it is in order (make sure that the voltage range set on the power supply unit is correct), the a.c. line fuse may have blown.

Check procedure

DANGER HIGH VOLTAGE!
Always disconnect the instrument from the power supply.

1. Open the panel over the fuse with a small screwdriver (see Fig. 8-1).
2. Remove the fuse holder (see Fig. 8-2).
3. Check the continuity of the fuse.
4. Replace the fuse if defective.
5. Reinsert the fuse holder (with the arrow facing to the right).
6. Close the panel over the fuse.
7. If the fuse blows again, consult your nearest W&G Service Center.

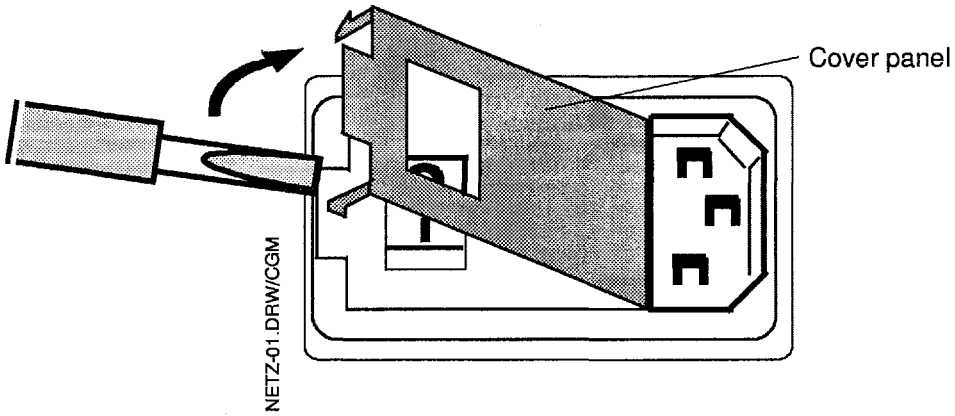


Fig. 8-1 Opening the fuse cover panel

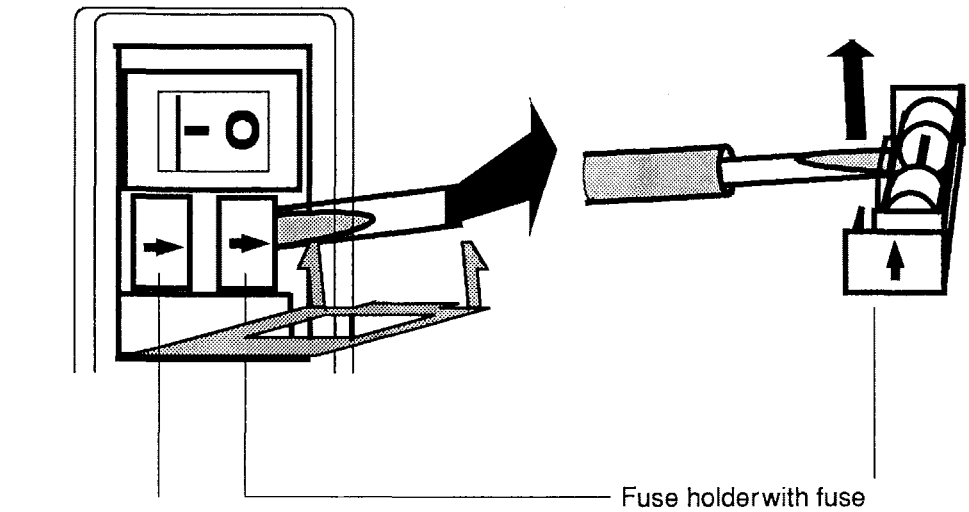


Fig. 8-2 Removing the fuse holder and fuse

8.2 Transport and storage

Please follow the instructions below if you need to dispatch an instrument, for example for repair by a W&G Service Center, in order to avoid damage in transit.

Packaging

Use the original W&G packaging again if possible, providing it is still intact.

If you are no longer in possession of the original packaging, please use a:

Humidity barrier for storage and transport in a humid environment

It is advisable to restore the humidity barrier provided in the original packaging if:

- The instrument is to spend a long time in transit.
- The instrument is to be stored for long time in an environment in which a high relative humidity may prevail.

Wrap the instrument in a strong plastic bag and add a sachet containing desiccant. Desiccant works with the aid of color indicators: the blue changes to pink when it is saturated.

Never put or leave water-saturated desiccant in the plastic bag. It may cause the humidity to rise and damage the instrument as a result!

Seal the plastic bag with strong adhesive tape.

Sturdy box

The box must be made of at least two-ply corrugated cardboard, which is at least 4 mm thick.

The dimensions of the box must be such as to allow the instrument to be padded all round with a material at least 70 mm thick. Hard-wearing plastic padding and corrugated cardboard are suitable materials for this purpose.

The padding must cover as much of the instrument as possible and hold it firmly in position, so that it is unable to move around inside the packaging. The gaps in-between can be filled with a loose padding material if desired.

A loose polystyrene padding material is however totally inadequate if used on its own!

Seal the box carefully along the joins. Use an adhesive tape made of 70 mm-wide kraft paper, which is fiber-reinforced both lengthways and crossways and which has a water-resistant coating.

Checklist

Compile a checklist of all the parts and enclose it in the box.

Notes:

9 Specifications, specification sheet

10 Measurement practice

10 Measurement practice

10.1 Measurements using external ALC for the TG

This section describes some things you need to keep in mind when making measurements using external automatic level control (ALC).

10.1.1 Internal ALC

The output level of the TG-23 is adjusted to maintain a constant value. Actual value sensing is generally performed by the built-in detector. This detector suffices for many measurement applications. The measurement accuracy can be further increased by making a reference measurement for comparison purposes. The test setup error with no DUT is stored in background memory B and the measurement is made in A-B display mode.
Nonetheless, the built-in detector can still only take into account what is known inside the instrument, such as the generator frequency response, error of the output attenuator, specifications for an external adapter, and so on.

Why are external detectors needed?

If the output level for a measurement must be held constant at a specific point in the test setup, an external detector is required. This device measures the level via a decoupling resistance at the point at which the DUT is connected. Based on the measured power, it generates an actual value signal which is used to adjust the generator. Certain parameters are provided to the instrument which indicate the characteristics of the detector.

10.1.2 Measurements with the EPM as the sensor

What is an EPM ?

The EPM-1 Milliwatt Power Meter from Wandel & Goltermann is a broadband power meter. This device can be used to measure a power level of 0 dBm with great precision. The frequency response is highly linear. Two probes are available: TK-10 for the range from 10 Hz to 300 MHz and TK-100 for 10 Hz to 1 GHz. The probe takes the incoming electrical power and converts it into thermal power using a thermal cross. As a result, the shape of the curve has no influence on the measurement results. The EPM-1 displays this thermal power as a power figure. To set up a control loop, the input power is also converted into a control voltage having a linear characteristic.

Benefits

The EPM-1 is a precision, temperature-compensated measuring instrument having a linear frequency response. The frequency response is a function of the test probe. Control loops can be set up for a level of 0 dBm.

10.1.2.1 Reference test setup

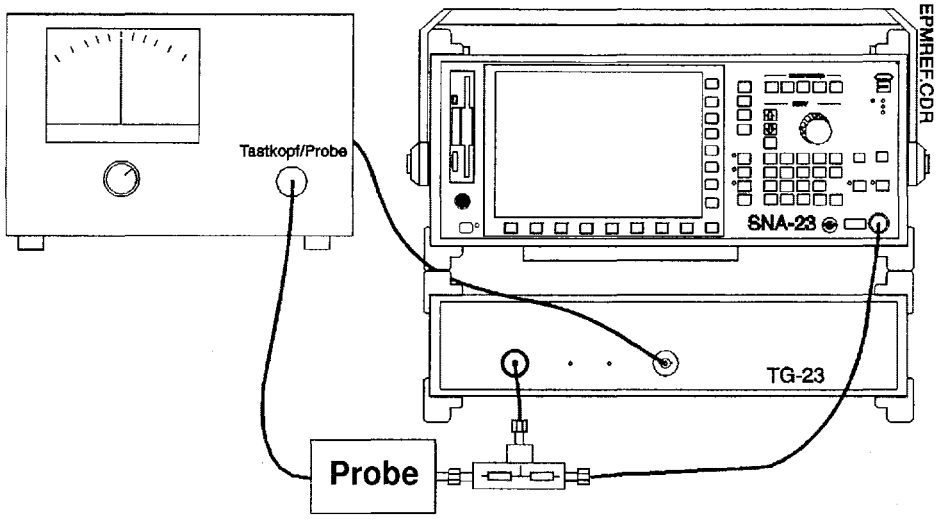


Fig 10-1 External ALC for the generator with the EPM-1 as sensor: Reference measurement

- Connect the generator output of the TG to the receiver input of the SNA via a power splitter.
- Connect the d.c. voltage output of the EPM-1 to the ALC input of the TG.
- Connect the EPM-1's probe to the power splitter.

Specifying the frequency measurement range

The frequency range is a function of the DUT and the test probe you use.

The frequency range can be set in two different ways:
- With [SF1] twice in a row (start and stop frequency), or
- With the FCENT key for the center frequency and the FSPAN key for the frequency span.

- In the SNA main menu, press **[SF1]** until **FSTART** is selected
- Input the new start frequency using the rotary control, step keys or keypad[1].
- Press **[SF1]** until **FSTOP** is selected.
- Input the new stop frequency using the rotary control, step keys or keypad.

Adapting the sweep time SWT to the settling time of the EPM

- Press **[SF6] SWT** in the main menu to enter the sweep time.
- Input the new sweep time using the rotary control, step keys or keypad.

Entering the cable loss as an external attenuation in the Generator menu

- Press **[F5] Generator...** in the main menu to open the Generator menu.
- Press **[SF8]** until **EXTERN ATTN** is selected.
- Input the loss of the connector cable using the rotary control, step keys or keypad.

Setting the generator level

- Press **[SF3] GEN LEVEL** to enter the generator level.
- Enter 0 dBm using the rotary control, step keys or 0 digit-->ENTER.

1 Terminate entries via the keypad with G for GHz or M for MHz or k for kHz or ENTER for Hz

Powering up the generator

- Press **[SF4] GENERATOR ON** to power up the generator output. The transmission of the DUT should now appear on the screen of the SNA, displayed vs. the selected frequency range.
- Press the **RTN** key to return to the main menu.

Measuring the intrinsic frequency response error through a reference measurement

- Press the **CLEAR TRACE** key to clear the current trace. Wait for a complete sweep pass to run.
- Press **[F1] TRACE...** to open the submenu.
- Press **[F3] TRACE MEMORY** to open the submenu.
- Press **[SF7] STORE A-->B** to store the current reference values in background memory.
- Press **[SF4] A-B** so that the difference between screen memory A and the reference measurement in B is measured and displayed.
- Press **[SF5] A-B ZERO POS** until the zero line becomes the uppermost graticule line (TOP).
- Press the **RTN** key to return to the main menu.

10.1.2.2 Test setup

- Insert the DUT between the power splitter and the receiver input of the SNA.

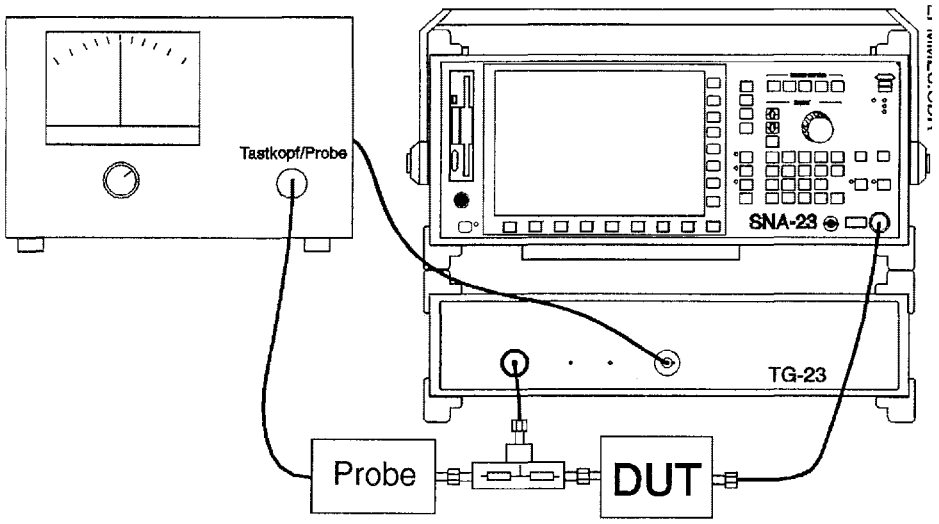


Fig 10-2 External ALC for the generator with the EPM-1 as sensor: Making the measurement

Switching over to the external EPM-1 sensor

- Press **[F5] Generator...** in the main menu to open the Generator menu.
- Press **[F6]** to open the **EXT. ALC** submenu.
- Press **[SF1]** to set **SENSE EPM**. The generator level is now regulated based on the voltage at the ALC input.

10.1.3 Measurements with a POWER METER as the sensor

What is a POWER METER?

A power meter is a broadband device for measuring power levels. The accompanying probe converts the incoming power in the measurement signal into a proportional d.c. voltage. The power meter displays this d.c. voltage as a power level. To set up a control loop, the input voltage is also converted into a control voltage having a linear characteristic. The slope of the characteristic can be adjusted with the RANGE parameter. This input power at which the maximum control voltage is attained is set in this manner.

Benefits

A power meter is a precision, temperature-compensated measuring instrument. Test probes with a wide frequency range are available. The frequency response is generally printed on the probe and must be taken into account when evaluating results. The characteristic of the output voltage is linear with selectable slope. It is typically equal to 1 V at the expected max. input level (RANGE value).

10.1.3.1 Reference test setup

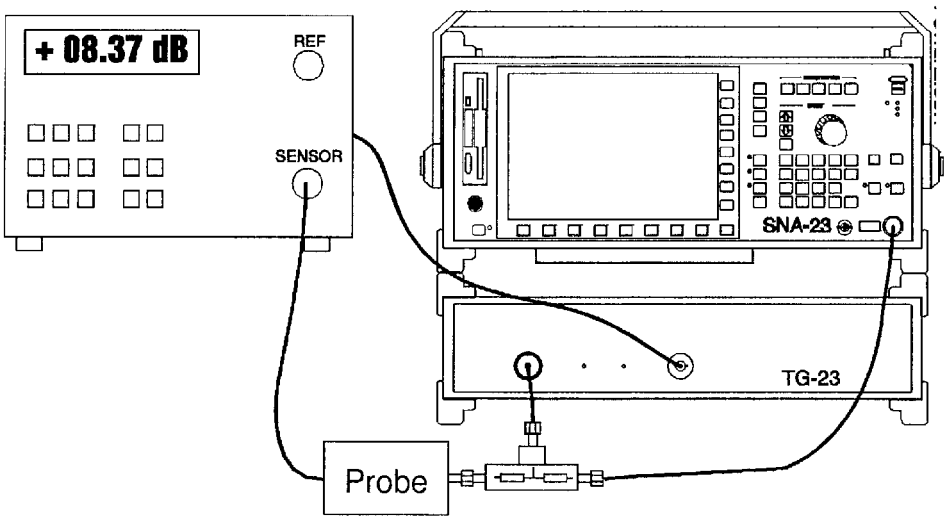


Fig 10-3 External ALC for the generator with a power meter as sensor: Reference measurement

- Connect the generator output of the TG to the receiver input of the SNA via a power splitter.
- Connect the d.c. voltage output of the power meter to the ALC input of the TG.
- Connect the power meter's probe to the power splitter.

Specifying the frequency measurement range

The frequency range is a function of the DUT and the test probe you use.

The frequency range can be set in two different ways:
- With [SF1] twice in a row (start and stop frequency), or
- With the FCENT key for the center frequency and the FSPAN key for the frequency span.

- In the SNA main menu, press **[SF1]** until **FSTART** is selected
- Input the new start frequency using the rotary control, step keys or keypad[1].
- Press **[SF1]** until **FSTOP** is selected.
- Input the new stop frequency using the rotary control, step keys or keypad[1].

Adapting the sweep time SWT to the settling time of the power meter

- Press **[SF6] SWT** in the main menu to enter the sweep time.
- Input the new sweep time using the rotary control, step keys or keypad.

Entering the cable loss as an external attenuation in the Generator menu

- Press **[F5] Generator...** in the main menu to open the Generator menu.
- Press **[SF8]** until **EXTERN ATTN** is selected.
- Input the loss of the connector cable using the rotary control, step keys or keypad.

Setting the generator level

Upper limit: Max. allowable level of the DUT or probe or max. generator level (generator output level - cable loss).
Lower limit: Min. input voltage of the ALC input (3 mV).

- Press **[SF3] GEN LEVEL** to enter the generator level.
- Enter the required generator level using the rotary control, step keys or digit keys-->ENTER.

Powering up the generator

- Press **[SF4] GENERATOR ON** to power up the generator output. The transmission of the DUT should now appear on the screen of the SNA, displayed vs. the selected frequency range.
- Press the **RTN** key to return to the main menu.

Measuring the intrinsic frequency response error through a reference measurement

- Press the **CLEAR TRACE** key to clear the current trace. Wait for a complete sweep pass to run.
- Press **[F1] TRACE...** to open the submenu.
- Press **[F3] TRACE MEMORY** to open the submenu.
- Press **[SF7] STORE A-->B** to store the current reference values in background memory.
- Press **[SF4] A-B** so that the difference between screen memory A and the reference measurement in B is measured and displayed.
- Press **[SF5] A-B ZERO POS** until the zero line becomes the uppermost graticule line (TOP).
- Press the **RTN** key to return to the main menu.

1 Terminate entries via the keypad with G for GHz or M for MHz or k for kHz or ENTER for Hz

10.1.3.2 Test setup

- Insert the DUT between the power splitter and the receiver input of the SNA

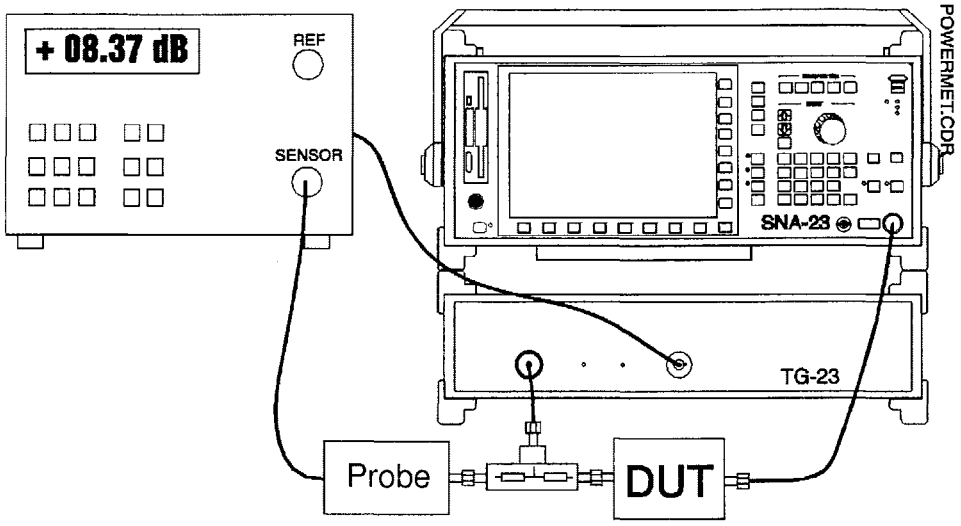


Fig 10-4 External ALC for the generator with the power meter as sensor: Making the measurement

Switching over to the external sensor (PWR METER)

On the power meter:

- Specify the display resolution and the expected maximum generator level (RANGE).
- Press **[F5] Generator...** in the main menu of the SNA to open the Generator main menu.
- Press **[F6]** to open the **EXT. ALC** submenu.
- Press **[SF5]** to open input of the **PWM RANGE**.
- Enter the RANGE value set on the power meter using the rotary control, step keys or digit keys -->ENTER.
- Press **[SF2]**to set **SENSE PWR METER**. The generator level is now regulated based on the voltage at the ALC input.

10.1.4 Measurements with a diode detector as the sensor

What is a diode detector?

A diode detector is basically a diode with impedance matching circuitry.

When power is applied to the diode, a current and a voltage arise across the dynamic internal impedance. The voltage is a function of the applied power level and not the frequency.

Depending on the characteristics of the diode, a frequency response error can also arise in the diode characteristic. To make practical use of this sort of device in ALC applications, the characteristic must be as linear as possible in the frequency range of interest.

As a general rule, no two detectors have the same characteristic. As a result, every detector must be measured prior to its use and its characteristic stored.

Benefits

A diode detector reacts very quickly since it does not have a control loop which must settle in. This device is thus well suited to high-speed measurements with fast sweep rates.

10.1.4.1 Entering the detector characteristic into a CAL TABLE

The calibration table can accept up to 15 values. Enter the values as follows:
- Left column: Generator power levels in decreasing order;
- Right column: Accompanying detector output voltages.

Select the values such that:
- The level range is suited to the measurement at hand;
- The values stored in the table provide a good indication of the detector characteristic;
- The level ranges of the detector, generator and ALC input are taken into account.

Hinweis: The table provided with the instrument is intended only for a basic functional test. To make practical measurements, you must create a table which describes the detector you use.

Switching off the automatic adaptation of the input divider

For small detector input voltages, the SNA input divider will sometimes switch over. This would result in a level error. You should thus switch off the automatic adaptation of the input divider before you create a CAL TABLE.

In the main menu of the SNA :

- Press **[SF7] ATTN** to enter the input attenuation.
- Press the **AUTO** key to switch off the automatic coupling (status display: ATTN AUTO OFF).

Test setup for measuring the detector characteristic

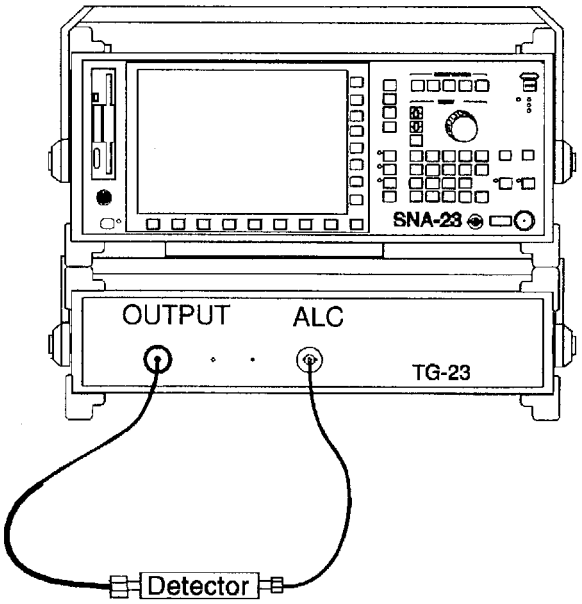


Fig 10-5 Measuring the detector characteristic and storing it in a CAL TABLE

- Connect the level input of the detector to the generator output of the TG.
- Connect the d.c. voltage output of the detector to the ALC input.

Creating the table

- Press **[F5] Generator...** to open the menu.
- Press **[F4] CAL TABLES** to call up the current calibration table.

Transferring the values from the SNA

- Press **[SF3] GEN LEVEL** to enter the generator level.
- Determine the allowable level range of the detector. Enter the maximum value on the keypad and press ENTER.

The TG now sets the output level; the accompanying output voltage of the detector is applied to the ALC input of the TG.

Hinweis: If the "UNLEVELED"LED lights up or an error message is generated, the set generator level is not possible across the entire frequency range. If this happens, reduce the frequency range or generator level.

- Press **[SF1] PREV ITEM** or **[SF2] NEXT ITEM** to select the first LEVEL value in the CAL TABLE (marked by a box).
- Press **[SF5] TRANSFER ACTUAL VALUE** to transfer the set generator level to the table.
- Press **[SF2] NEXT ITEM** to select the accompanying VOLTAGE in the table.
- Press **[SF5] TRANSFER ACTUAL VALUE** to transfer the detector voltage measured at the ALC input to the table.
- Press **[SF2] NEXT ITEM** to select the next LEVEL value in the table.
- Press **[SF3] GEN LEVEL** to enter the generator level.
- Enter the value on the keypad and press ENTER.
- Press **[SF5] TRANSFER ACTUAL VALUE** to transfer the set generator level to the table.
- Press **[SF2] NEXT ITEM** to select the accompanying VOLTAGE in the table.
- Press **[SF5] TRANSFER ACTUAL VALUE** to transfer the measured detector voltage to the table.
- . . . and so on.
- From the values in the table, you can see where the output voltage loses its linearity with respect to the input level.
- Mark the end of the table with an invalid entry (siehe auf Seite 10-9)

Warning: The ALC input of the TG has a lower voltage threshold of approx. 3 mV. Smaller detector output voltages might not be recognized in the noise. By inserting a amplifier (e.g. 10x), you can shift the level range. The lower limit is then determined by the detector noise.

Entering values from a reference measurement or a table

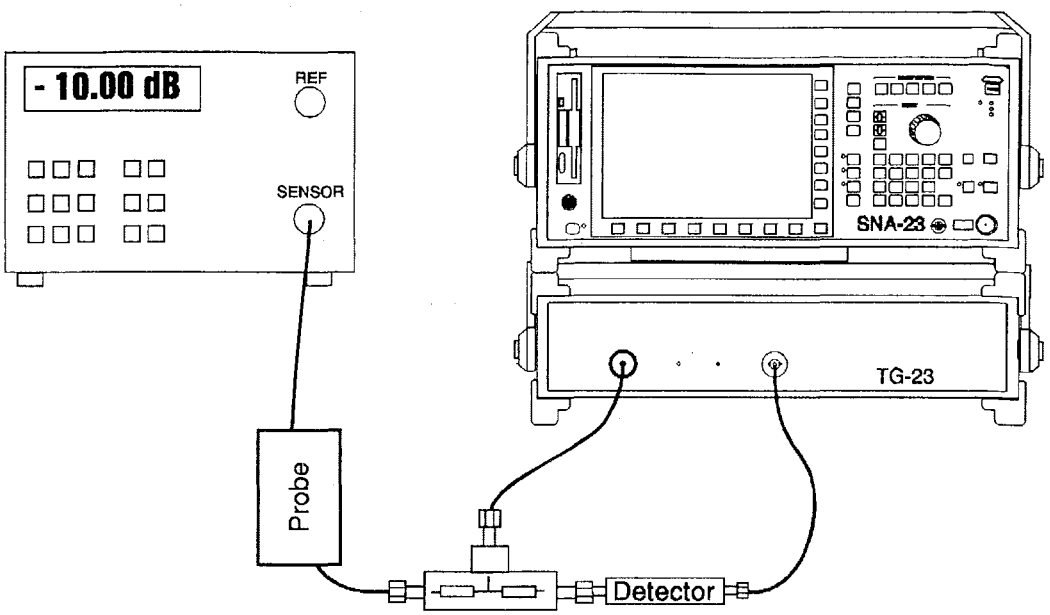


Fig 10-6 Measuring the detector CAL TABLE with a power meter as a reference

You can also enter the output voltage manually (e.g. if the value is known from a data sheet). The sign is not necessary.

- Press **[SF1] PREV ITEM** or **[SF2] NEXT ITEM** to select the first LEVEL value in the CAL TABLE (marked with a box).
- Press **[SF4] EDIT ITEM** to open input.
- Input the new level using the rotary control, step keys or keypad[1].
- Press **[SF2] NEXT ITEM** to select the accompanying VOLTAGE value in the table.
- Press **[SF4] EDIT ITEM** to open input.
- Input the new detector output voltage using the rotary control, step keys or keypad[1].
- ...and so on.

Ending the table

You do not have to enter all 15 pairs of values in the table. If a generator level is set which is not included in the table, the instrument software interpolates the values in the table to find the correct value.

Indicate the end of valid entries by entering an invalid value manually. The following are invalid values:

- A level which is greater than the preceding value in the table;
- A voltage of 0 V;
- A voltage which greater than the preceding value in the table.

1 Terminate entries via the keypad with M for mV/mB or ENTER for Volt/dB.

10.1.4.2 Measurement example

We would like to measure the frequency response of a filter. An external detector is used to maintain a constant generator level at the input to the filter. In the frequency range of interest, the frequency response error should be negligible (or the error known).

Setting the frequency range

The frequency range can be set in two different ways:
- With [SF1] twice in a row (start and stop frequency), or
- With the FCENT key for the center frequency and the FSPAN key for the frequency span.

- In the SNA main menu, press **[SF1]** until **FSTART** is selected
- Input the new start frequency using the rotary control, step keys or keypad[1].
- Press **[SF1]** until **FSTOP** is selected.
- Input the new stop frequency using the rotary control, step keys or keypad.

Optimizing the parameters

Since the detector is very fast-acting, everything which applies to the internal detector also applies here (Abschnitt 4.1.10 auf Seite 6).

Entering the cable loss as an external attenuation

- Press **[F5] Generator...** in the main menu to open the Generator main menu.
- Press **[SF8]** until **EXTERN ATTN** is selected.
- Input the loss of the connector cable using the rotary control, step keys or keypad.

Setting the generator level

- Press **[SF3] GEN LEVEL** to enter the generator level.
- Enter the required generator level using the rotary control, step keys or digit keys.

Powering up the generator

- Press **[SF4] GENERATOR ON** to power up the generator output. The transmission of the DUT should now appear on the screen of the SNA, displayed vs. the selected frequency range.
- Press the **RTN** key to return to the main menu.

Measuring the intrinsic frequency response error through a reference measurement

- Connect the d.c. voltage output of the detector to the ALC input of the SNA.
- Connect the level input of the detector to the power splitter.
- Connect the generator output of the TG to the receiver input of the SNA via the power splitter.

1 Terminate entries via the keypad with G for GHz or M for MHz or k for kHz or ENTER for Hz

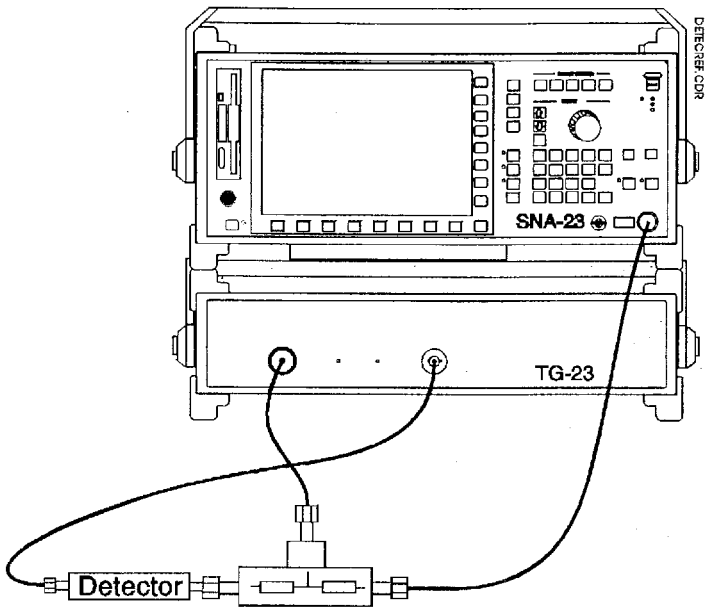


Fig 10-7 External ALC for the generator with the detector as sensor: Reference measurement

- Press the **CLEAR TRACE** key to clear the current trace. Wait for a complete sweep pass to run.
- Press **[F1] TRACE...** to open the submenu.
- Press **[F3] TRACE MEMORY** to open the submenu.
- Press **[SF7] STORE A-->B** to store the current reference values in background memory.
- Press **[SF4] A-B** so that the difference between screen memory A and the reference measurement in B is measured and displayed.
- Press **[SF5] A-B ZERO POS** until the zero line becomes the uppermost graticule line (TOP).
- Press the **RTN** key to return to the main menu.

Measurement

Switching over to the external detector

- Press **[F5] Generator...** in the main menu to open the Generator main menu.
- Press **[F6]** to open the **EXT. ALC** submenu.
- Press **[SF3]** to set **SENSE DETECTOR**. The generator level is now regulated by the voltage on the ALC input. Since a detector is selected as the nominal value specifier, the CAL TABLE specified under [SF6] DETECTOR # n is used as a characteristic.

If this CAL TABLE does not correspond to the connected detector:

- Press **[SF6] DETECTOR # n** to open input.
- Enter the number under which the characteristic for the current detector is stored. Example: DETECTOR #1 calls up the table which was stored using SAVE #1 in the CAL TABLES menu.

Inserting the DUT

- Insert the DUT in the test setup. The frequency response of the DUT will now be displayed.

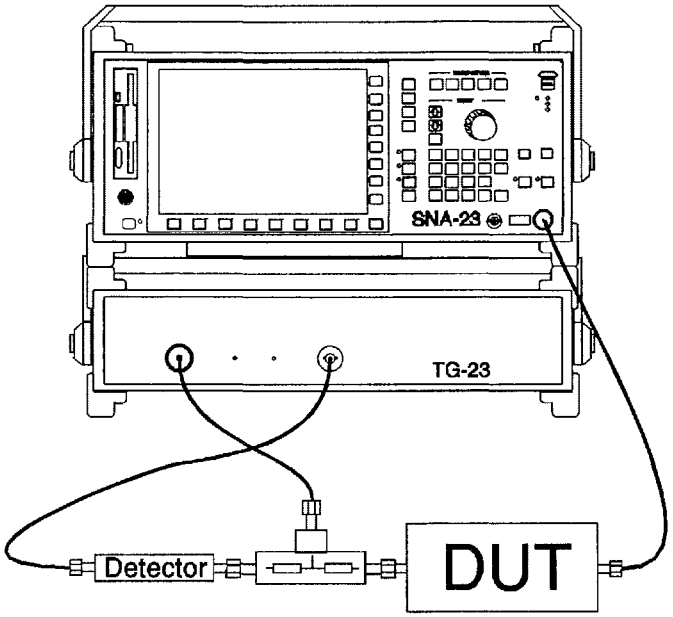


Fig 10-8 Once the proper CAL TABLE is loaded for the detector and the DUT is connected, the frequency response of the filter is displayed.

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Symbols

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