TEST SYSTEM FOR CONDUCTED AND RADIATED IMMUNITY

NSG 4070

USER MANUAL

TESEQ

Advanced Test Solutions for EMC

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USER MANUAL

CONTENS

FIGURES

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1. SAFETY ADVICE

The generator and its accessories operate at mains voltage.
These operating instructions form an integral part of the equipment and must be available to the operating personnel at all times. All the safety instructions and advice notes are to be observed.
Neither Teseq GmbH nor any of its subsidiary sales organizations can accept any responsibility for personal, material or consequential injury, loss or damage that results from improper use of the equipment and accessories.

WARNING: Improper or careless handling can be fatal!
Use of the NSG 4070 is restricted to authorized and trained specialists

1.1. General

- Use of the NSG 4070 is restricted to authorized and trained personnel only.
- The NSG 4070 is to be used only for the purposes indicated by the manufacturer..
- Persons fitted with a heart pacemaker must not operate the instrument nor approach the test setup while it is in operation.

1.2. Safety symbols used on the product

Attention
Refer to manual
First connect PE (protective earth) to the earth terminal

Protective earth
(earth terminal)

1.3. Connection to the mains and PE

- The instrument conforms to protection class 1.
- Operation without a protective earth connection is forbidden!
- Handle the power cord carefully. Never use the product if the power cable is damaged.
- Ensure that a reliable return path for the interference current is provided between the equipment under test (EUT) and the generator. The reference ground plane and the earth connections to the instrument as described in the relevant test standard serve this purpose well.

1.4. Risk of electric shock

- To reduce the risk of electric shock, do not remove parts from the housing.
- There are no user serviceable parts inside the unit. Certain parts inside the instrument work at mains voltage or at high frequency and are not provided with any protection against being touched.
- Only approved accessory items, connectors, adapters, etc. are to be used to ensure safe operation.

1.5. Operating Environment

- Operate the equipment only in dry surroundings. Allow any condensation that occurs to evaporate before putting the instrument into operation. Do not exceed the permissible ambient temperature, humidity or altitude.
- Do not insert foreign objects in the ventilation holes.
- Do not obstruct the ventilation holes. Ventilation should not be impeded by covering the ventilation openings with items or other equipment.
- Do not place the product on radiators or fan heaters. The ambient temperature must not exceed the maximum specified temperature of this product.

1.6. Test execution

- The test area must be organized that no unauthorized persons have access during execution of a test.
- Operating the product requires special training and intense concentration. Make certain that persons who use the products are physically, mentally and emotionally fit enough to operate the products; otherwise injuries or material damage may occur.
- EUTs together with all accessories and cables are to be regarded as being live during the execution of a test.
- The safety instructions concerning all the instruments and associated equipment involved in the test setup are to be observed.
- The configuration of the test setup is to be strictly in compliance with the methods described in the relevant standard to ensure that the test is executed in a compliant manner.
-

1.7. Dangers concerning the generator

- The generator works with both high frequency signals (RF) and mains voltages. Improper operation or installation can result in RF energy being radiated which can lead to disruption of nearby installations. Operation in a Faraday cage is therefore imperative!
- Localized burning, arcing or ignition of explosive gases.
- Hazard caused through damage to a test object.
- Disruption of unrelated electronic, telecommunications or navigational installations or heart pacemakers through unintentional radiation of RF energy.

1.8. Dangers concerning the EUT

- EUTs are frequently simply functional samples that have not previously been subjected to any safety tests. Therefore in some cases, the EUT is quickly damaged through internal overloads caused by the control electronics being disrupted. The EUT may even begin to burn.
- As soon as the EUT shows signs of damage the test should be stopped and the equipment under test should be switched off.
- Possible erroneous behavior by the EUT for example, a robotic device may misbehave, or a temperature regulator may fail.

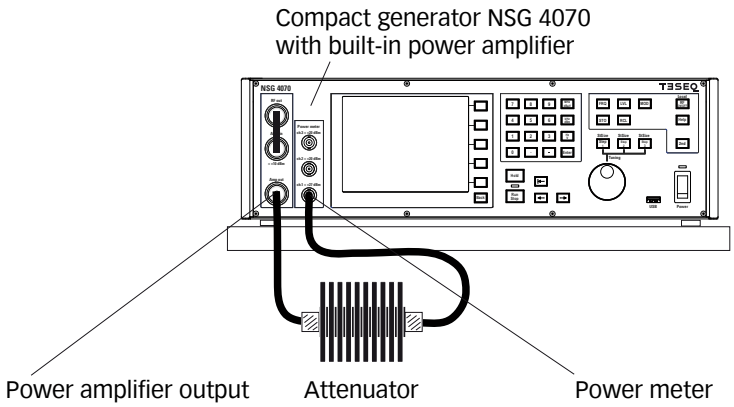
1.9. Applicable safety standards

- Development and manufacture of the instrument complies with ISO 9001.
- The equipment conforms with the essential requirements of the EMC Directive 2004/108/EC and Low Voltage Directive (LVD) 2006/95/EC based on the following specifications applied: DIN EN 61326-1:2006, table 2 and chapter 7 class B and DIN EN 61010-1:2001
- All mains powered types of generator are equipped in accordance with VDE 0104. For further details see the section entitled “Standards”.
- It is the user’s responsibility to ensure that the test setup does not emit radiation which could disrupt other equipment. The generator itself does not produce excessive radiation; however the test object and associated cabling might do so.
- Since the purpose of this instrument is to produce interference signals to test interference immunity characteristics, the regulations concerning the limitation of radiated EMI as contained in EN 61326/2004 can only be respected if the equipment is operated in a Faraday cage.

1.10. Safety advice

Generator mode

The power meter inputs are very sensitive. Please avoid any direct connection as shown below with careless adjustment of the generator output level. Be careful with low loss attenuators.



Mode Level	Generator mode -30 dBm	Generator mode -10 dBm
Amplifier (e.g. 50 dB)	On	On
Amp output (forward power)	20 dBm	40 dBm
Attenuator	6 dB	6 dB
Power meter ch. 1 limit	27 dBm	27 dBm
Measured on ch. 1	-30+50-6= 14 dBm	-10+50-6= 34 dBm

Immunity mode

The immunity mode is less dangerous as long as the calibration set up is used. Please avoid any direct connection between power amplifier output and power meter input.

The operation mode “Calibration of the monitor probe“ is safe for the measurement of attenuators, cable losses and probes. Direct connection is allowed.

2. STORAGE, TRANSPORT, UNPACKING AND DELIVERY INFORMATION

2.1. General

Save all packing materials! They will be needed in order to safely package the equipment for calibration service or repair.

Packaging materials

- Carton: Cardboard
- Padding: CFC-free polystyrene foam
- Plastic bags: Polyethylene

- Avoid risk of condensation!

If a large temperature differential has occurred, allow time for the temperature to stabilize. This may take several hours.

2.2. Storage and transport

- Do not stack, either packed or unpacked.
- Do not stand on end; arrows on the packaging must always point upwards.
- Protect from dampness, heat, cold and rain
- Do not throw
- Do not sit or stand on the instrument and packaging.

2.3. Unpacking

- Is the packaging damaged? If YES ☎ transportation company
- Are all the packages present and correct? If NO ☎ transportation company
- Open the packaging, remove the accessories.
- Grip the instrument at the sides and lift it from the packaging.
- Are the instrument or accessories damaged? If YES ☎ transportation company
- Are the contents of the package complete? If NO ☎ Teseq sales office
- Keep the instruction manual with the instrument.
- Keep the packaging.

2.4. Model range and options

Part number	Description
253293	NSG 4070-0 Compact immunity test system NSG 4070, 9 kHz - 1 GHz RF generator and power meter (without power amplifier)
253292	NSG 4070-20 Compact immunity test system NSG 4070, 9 kHz - 1 GHz RF generator and power meter (with 20 W module 150 kHz - 230 MHz)
253291	NSG 4070-30 Compact immunity test system NSG 4070, 9 kHz - 1 GHz RF generator and power meter (with 30 W module 150 kHz - 230 MHz)
253290	NSG 4070-75 Compact immunity test system NSG 4070, 9 kHz - 1 GHz RF generator and power meter (with 75 W module 150 kHz - 230 MHz)
97-253290	NSG 4070-TC Traceable calibration (ISO17025), order only with the device

98-253290	NSG 4070-DKD DKD calibration (ISO17025), order only with device NSG 4070
253840	NSG 4070 Rack Rack mounting kit for NSG 4070
253104	LE 4070 RF cable set for NSG 4070, consist of: RF cable, N(m)-N(m), 3 m with one right-angle plug, RG223; RF cable, BNC(m)-N(m), 250 mm, RG223; RF cable, N(m)-N(m), 120 mm, RG58; RF cable, N(m)-BNC(m), 2 m, RG223; adapter N(m)-N(m); adapter N(f)-BNC(m)
235308	ATN 6025 Attenuator 25 W cw N(f)-N(f)
235309	ATN 6050 Attenuator 50 W cw N(f)-N(f)
235307	ATN 6075 Attenuator 75 W cw N(f)-N(f), incl. cable LE 213
For CDNs, EM clamp, current injection probes, BCI accessories and antennas please use the web page www.teseq.com.	

2.5. Scope of delivery

- NSG 4070 mainframe
- Operating manual
- Remote software on USB stick
- Spare fuses (2)
- RS232 cable (Nullmodem)
- Mains cable GB
- Mains cable CH
- Mains cable USA/JP
- Mains cable EU
- LAN cable, crossover, 3 m
- Keyboard (English)

3. DESCRIPTION OF THE INSTRUMENT

3.1. General

The NSG 4070, successor of the NSG 2070, is a multifunctional EMC immunity test system. Its wide frequency range from 9 kHz to 1 GHz and its modular design using internal or external amplifiers enable a large variety of applications including tests according to IEC/EN 61000-4-6, ISO 11452-4 and others. Powerful and easy to use firmware makes it possible to operate the NSG 4070 as a stand-alone unit. However, it can also be controlled remotely by external software as part of a system. Convenient test and measurement data transfer for documentation is provided by a USB stick which is plugged into the front panel.

All the possible coupling methods within the specified bandwidth, such as CDN (Coupling Decoupling Network) coupling clamp or a BCI (Bulk Current Injection) probe can be simply connected and calibrated. This eliminates the need for complex measurements on mostly non-linear coupling paths. During the calibration procedure the generator automatically corrects for any deviation and stores the correction details.

Various sweep modes are available which can be specifically selected to suit each particular test.

In addition to the normal sweep applications, interference effects such as those caused by a pulsed interference source can be simulated in the pulse mode of operation.

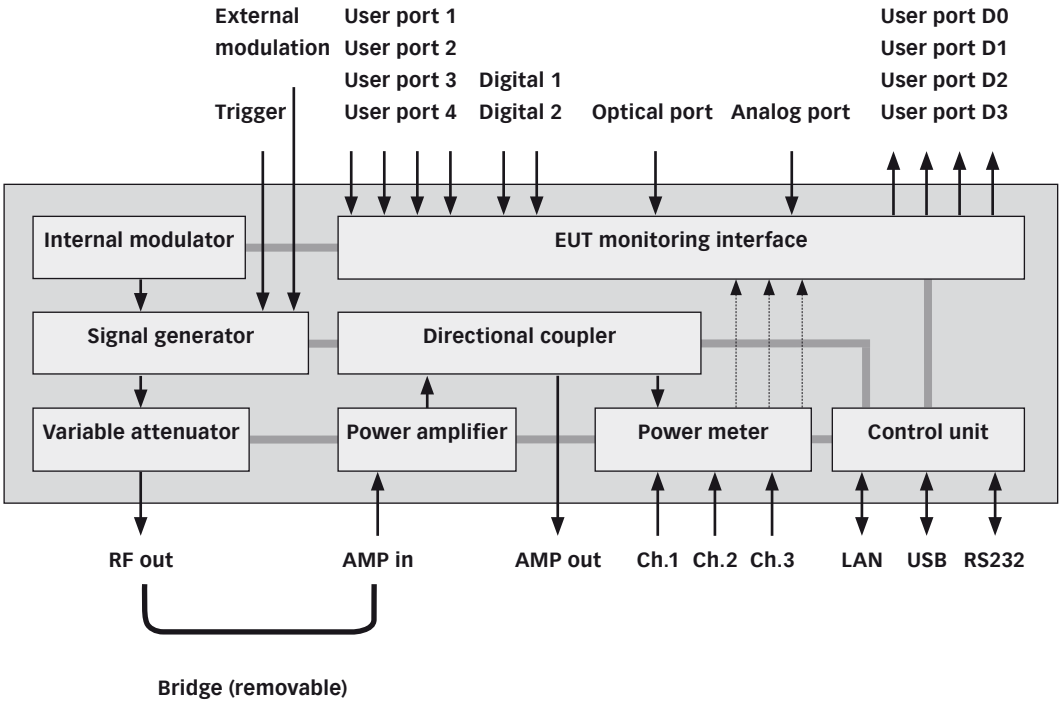


Figure 1: Block diagram of NSG 4070 with internal power amplifier

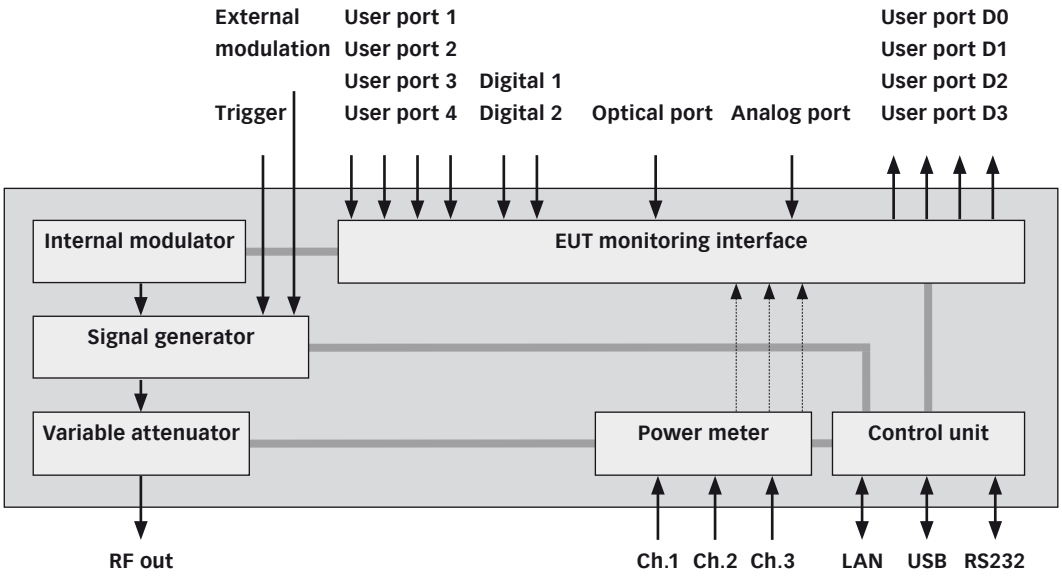


Figure 2: Block diagram of NSG 4070-0

3.2. Operating elements

3.2.1. Front panel

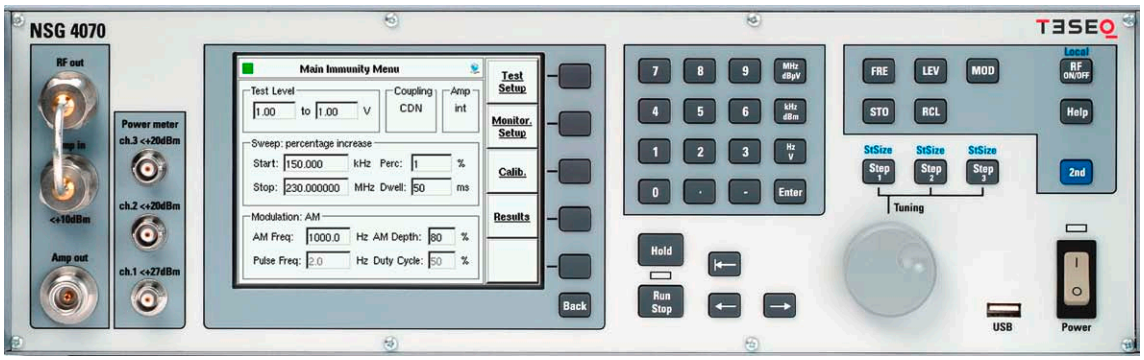


Figure 3: Front view of NSG 4070 with built-in power amplifier

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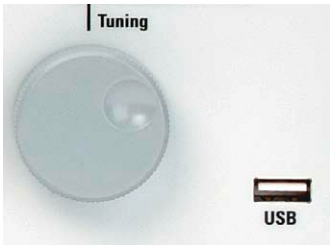
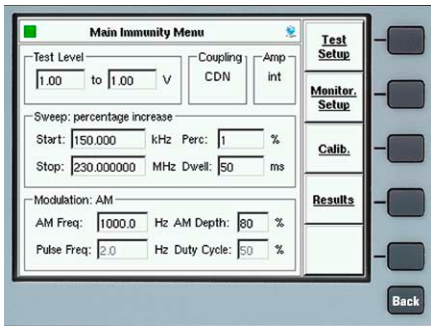
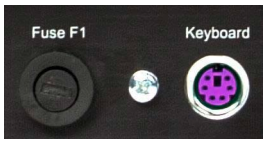
1		**Power**	**Power on key** Hard key, switching takes effect with a short delay The LED next to the switch will turn from yellow to green when the unit is switched on.
2		**FRQ** **LVL** **MOD** **STO** **RCL** **Step 1, Step 2, Step 3**	**FRQ** Opens a softkey menu to change the frequency **LVL** Opens a softkey menu to change the test level **MOD** Opens a softkey menu to change the modulation parameters **STO** Opens a softkey menu to store test data or configurations **RCL** Opens a softkey menu to load test data or configurations **Step 1, Step2, Step 3** Keys to select one of the three step sizes
3		**RF ON/OFF** **Help** **2nd**	**RF ON/OFF** Switches the internal signal generator on/off **Help** Key to call up the help text for all operating conditions. Depending on the current settings, explanations to the help function, explanations to hard and softkeys, and for adjustment facilities within menus will be displayed. **2nd** Additional function: marked in blue color **2nd + Local** Keys to switch from remote control to manual operation **2nd + StSize** Keys to change the step size, affects e.g. the using of the rotary knob

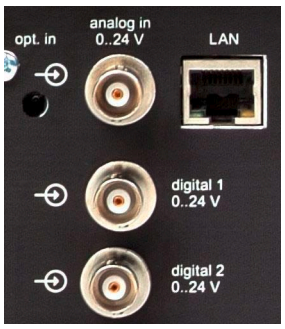
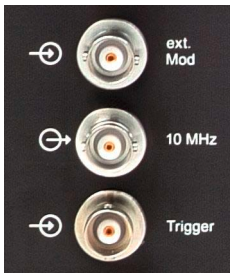
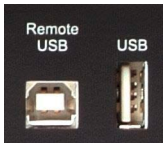
4		**Tuning** **USB**	**Tuning** The rotary knob has magnetic lock-in positions for parameter tuning and selection purposes. **USB** Interface for data exchange with USB stick
5		**0…9** **-** **.** **MHz/dBµV** **kHz/dBm** **Hz/V** **Enter**	**Numeric keyboard** numerical entry keys **Minus sign** **Decimal point** **Input confirmation keys** for the desired unit
6		**Hold** **Run/Stop** ⇤ ← →	**Hold** Interrupts a sweep. The blinking yellow LED indicates the Hold state. There is a RF signal at the output. **Run** Starts the sweep specified in the setup. The blinking red LED indicates the RUN mode. **Stop** Stops a sweep that is currently running. The LED turns to green. **Delete** the character left of the cursor **Moves** the cursor left **Moves** the cursor right

7		**Display** **Softkeys** **Back**	**Display** Displays menus, softkeys and results. **5 Softkeys**, whose individual functions are dependent on the menu context. **Back** Key to return from any operating condition (menu, canceling of entries, error messages) to the preceding higher-level menu
8		**Power meter channel 1 to 3**	**Power meter inputs** Impedance Z= 50 Ω BNC-socket Caution! Maximum input level +20 dBm for channel 2 and 3. Maximum input level +27 dBm for channel 1. If necessary use voltage limiters or attenuators. Channel 1 is used for calibration.
9		**RF out** **Amp in** **Amp out**	**RF out** Synthesizer output to drive an external amplifier or use the NSG 4070 generator function. **Amp in** Power amplifier input (the power amplifier is optional) Caution! Maximum input level <+10 dBm. **Amp out** Power amplifier output (the power amplifier is optional)

3.2.2. Back panel

Figure 4: Back view of NSG 4070

10		**Power supply**	Power supply connector for wide range supply: 110 / 230 Volts, 50/60 Hz autoranging
11		**Fuse** **Keyboard**	**Fuse F1** See technical specifications for selection guide of fuse F1. **Keyboard** PS/2 keyboard connector
12		**User port** **RS232**	**User port D-Sub 15 pole** **Port** **Pin** Digital in 0 1 Digital in 1 2 Digital in 2 3 Digital in 3 4 Digital out 0 6 Digital out 1 7 Digital out 2 8 Digital out 3 9 +12 V 15 -12 V 14 +5 V 13 GND 5 and 10 RS232 - interface for remote control of the NSG 4070 using a null modem connection

13		**Optical input** **Analog input** **Digital 1 and 2 input** **LAN**	Fiber optic cable plug, HP versatile link HFBR0501 series 40 kBd Monitoring input analog, BNC socket, 0-24 V Ri=15 kOhms, 6 mV resolution Monitoring digital input 1 and 2, BNC socket, 0-24 V via optical coupler Ri=1.5 kOhms, switching threshold approx. 2 to 3 V Network connector 10 / 100 Ethernet
14		**Ext. Mod.** **10 MHz** **Trigger**	External modulation input BNC socket, Impedance >10 kOhms Level: 1 Vpp / 100% AM, 1 Hz – 50 kHz 10 MHz reference output BNC socket, approx. 1 Vpp / 50 Ohms Trigger input BNC socket, TTL for external triggering
15		**Remote USB** **USB**	USB device connector USB host connector
16		**Fans**	3 Fans for cooling the internal parts of the unit

4. EXPLANATION OF THE MENU-CONTROLLED OPERATION

4.1. General

4.1.1. Menu control with softkeys and hardkeys

The function of each softkey is shown on the display, and can be operated using the 5 keys at the right of the screen.

A selection will be terminated either by pressing one of the enter/unit keys or another softkey or automatically.

Menus can be quit using "BACK". Pressing "BACK" several times will always lead back to the main menu ("Main").

4.1.2. Help function ("HELP")

The "HELP" key enables the display of a help text in most operating situations.

4.1.3. Numerical input using the numerical keyboard

Inputs of numerical values must start with a digit or the minus sign and will be terminated by one of the enter/unit keys for the desired unit. The input value appears in the selected field. Typos can be corrected using backspace ← to delete the digit to the left of the cursor. Mistakes will usually be corrected to the nearest valid value; too many input digits will be rounded.

4.1.4. Secondary functions

The secondary function of some keys is marked above the keys in blue. For calling a secondary function press the "SECOND"-key (blue key) and then the desired function key.

4.1.5. Level setting, frequency setting, modulation setting and tuning

4.1.5.1. Level setting

Level setting is done using the "LVL" hard key. The desired level can be set either by typing in a numerical value or by using the rotary knob which sets the level in fixed steps.

4.1.5.2. Frequency setting

Frequency setting is done using the "FRQ" hard key. The desired frequency can be set either by typing in a numerical value or by using the rotary knob which sets the frequency in fixed steps.

4.1.5.3. Modulation setting

Modulation frequency setting is done using the "MOD" hard key. The desired modulation parameters, i.e. AM, pulse or external modulation as well as the modulation frequency and depth / duty cycle can be set.

4.1.5.4. Tuning using the rotary knob

The rotary knob is used for frequency or level tuning.
"STEP1", "STEP2" and "STEP3" are user defined step sizes. The step size can be defined by pressing the "SECOND" key and "STEP1", "STEP2" or "STEP3" and typing in a numerical entry. The desired step size can be selected by pressing the corresponding key (without "SECOND" key). The current step size is displayed in the lower left corner of the screen ("GENERATOR" window).

4.1.6. Saving and loading of configurations and results

4.1.6.1. General

There are two options for storing or recalling results:
a) Saving/recalling data to/from the internal flash disk.
b) Saving/recalling data to/from the USB stick.

4.1.6.2. Store

The hard key "STO" opens a menu to save configurations, calibration and measurement results. Menu items include:

"CONFIG": To save the settings of the current measurement as a configuration file to the internal flash or USB stick.

"CALIB. DATA": To save the calibration results of the test setup to the internal flash or USB stick.

"PROBE CAL.": To save the calibration results of the monitoring probe to the internal flash or USB stick.

"RESULTS": To save the measurement results of the current measurement together with the corresponding configuration as a result file to the internal flash or USB stick.

Return from the sub menu with "BACK".

4.1.6.3. Recall

The hard key "RCL" opens a menu to load configurations, calibration and measurement results. Menu items include:

"CONFIG": To recall the settings from the internal flash or USB stick.

"CALIB. DATA": To recall the calibration results of the test setup from the internal flash or USB stick.

"PROBE CAL.": To recall the calibration results of the monitoring probe from the internal flash or USB stick

"RESULTS": To recall the measurement results together with the corresponding configuration from the internal flash or USB stick.

Return from the sub menu with "BACK".

4.2. Main menu

The "MAIN" menu of the NSG 4070 is always displayed after switching on the device. The "MAIN" menu provides the following choices: "SETUP" to access the general configuration, "POWER METER" mode, "GENERATOR MODE", "IMMUNITY MODE", or "INFO" to obtain information on the hardware/software configuration and device serial number.

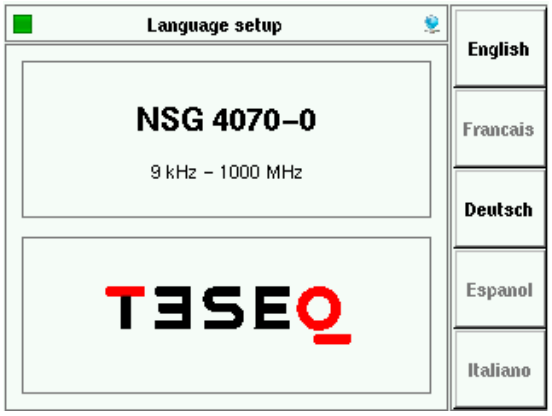
4.3. Setup

"DEVICE SETUP" provides access to the device configuration.

4.3.1. Setup —> General

"GENERAL SETUP" provides access to the language, display colors and date & time configurations.

4.3.1.1. Setup —> General —> Language setup

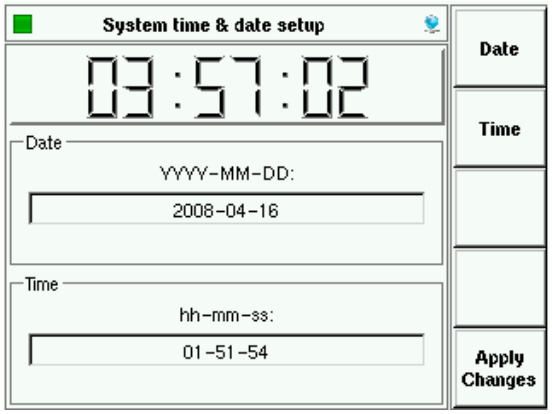


Language can be selected in this setup. The unit needs to be restarted after changing the language.

4.3.1.2. Setup —> General —> Color theme setup

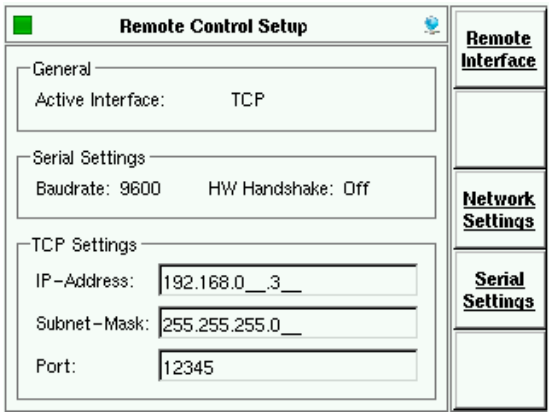
"COLOR SETUP" allows the user to change the color of the display.

4.3.1.3. Setup —> General —> System time & date setup



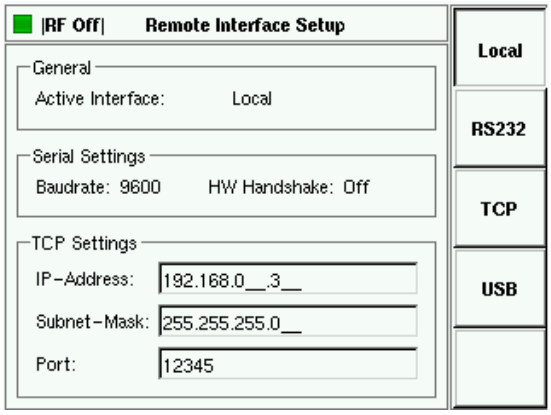
Time and date can be set in this submenu.

4.3.2. Setup —> Remote control setup



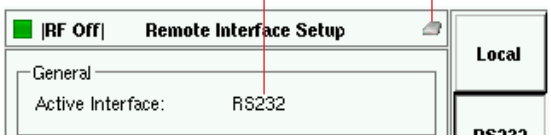
"REMOTE CONTROL SETUP" provides the remote control settings of the device. This main screen gives an overview about the current parameters. Submenus provide access to the parameters.

4.3.2.1. Setup —> Remote control setup —> Remote interface setup

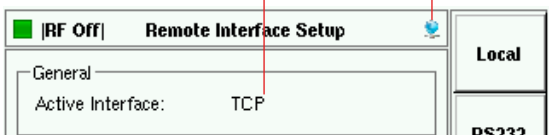


"REMOTE INTERFACE SETUP" allows the user to change the remote port. The selection "LOCAL" prohibits remote control.

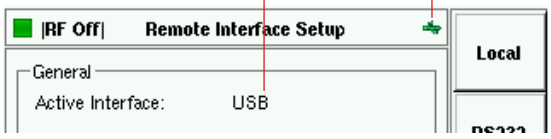
RS232 is selected as remote interface.



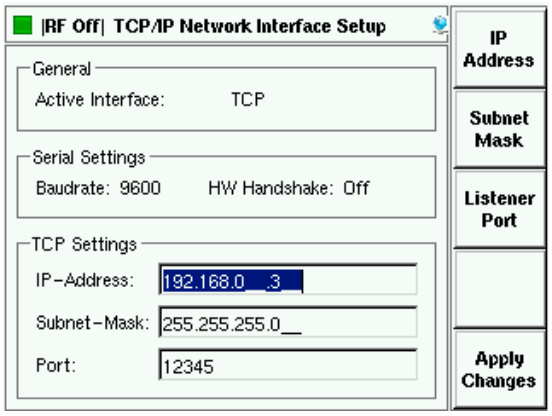
TCP is selected as remote interface.



USB is selected as remote interface.

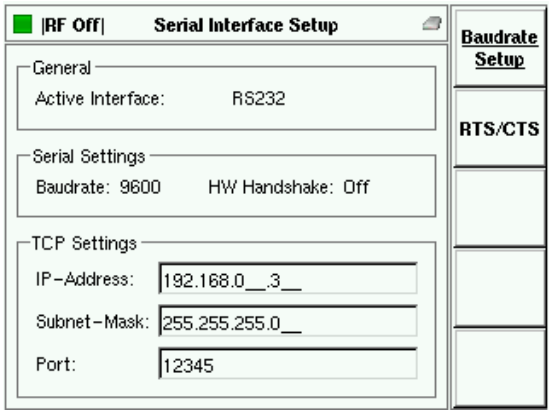


4.3.2.2. Setup —> Remote control setup —> TCP/IP Network interface setup

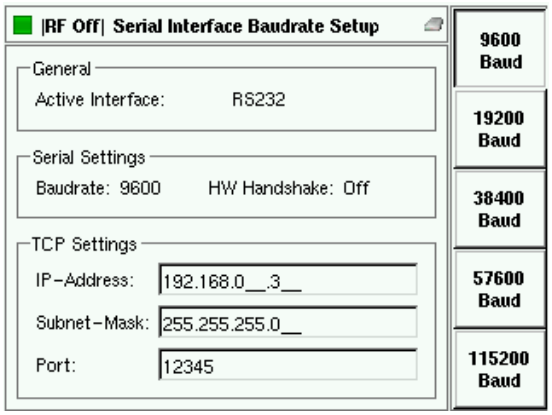


Settings for the TCP/IP network can be changed in this setup.

4.3.2.3. Setup —> Remote control setup —> Serial interface setup

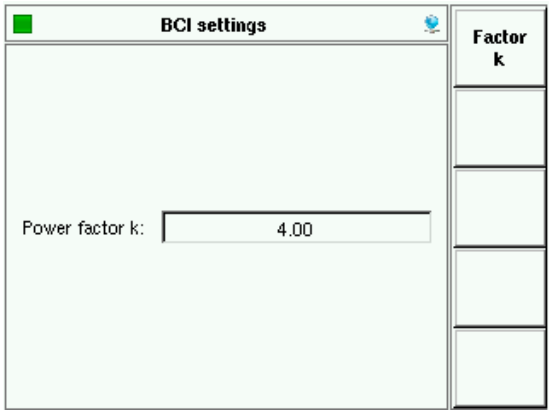


Settings for the serial interface can be changed in this setup. Submenus provide access to the parameters for the baudrate and to switch the handshake on/ off.



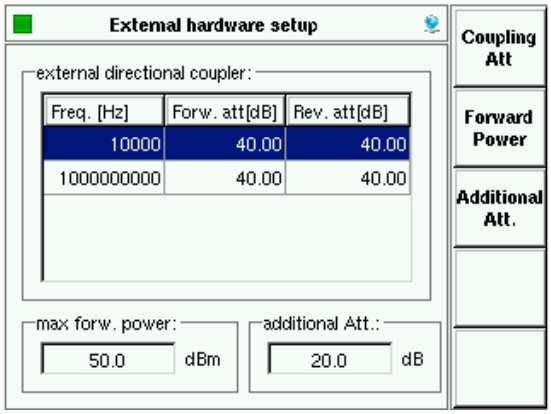
Baudrate can be chosen in the baudrate setup.

4.3.3. Setup —> BCI settings



"BCI SETTINGS" allows the user to set a power limitation factor as described in the ISO 11452-4 standard. The default value is 4. This parameter can only be set in this menu and is also valid for remote operation with "NSG 4070 Control Program".

4.3.4. Setup —> External hardware setup

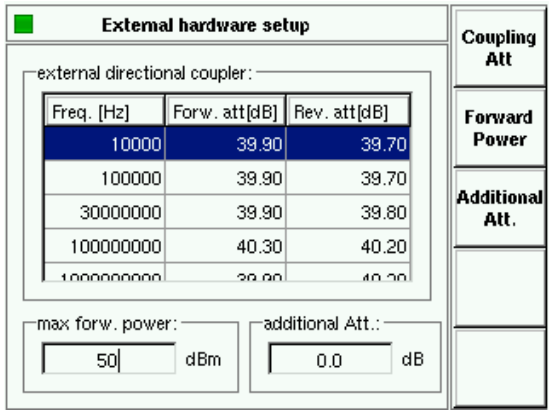


The softkey "COUPLING ATTENUATION" offers the import function for the coupling attenuation calibration factors of the external directional coupler as described in the next text box.

The softkey "FORWARD POWER" allows the user to set a limit for the maximum forward power.

The softkey "ADDITIONAL ATTENUATOR" allows the user to use an additional attenuator to protect power meter 1 against levels above the maximum input power of this channel.

4.3.4.1. Setup —> External hardware setup —> Coupling attenuation



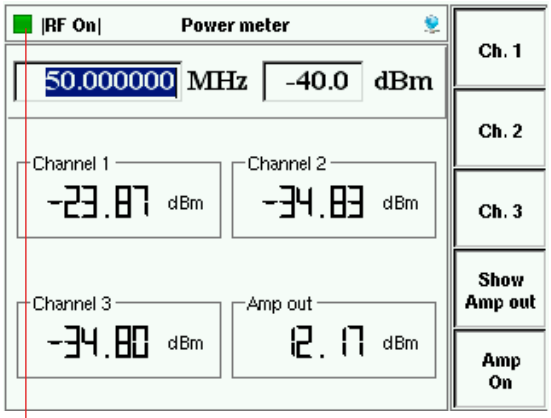
The use of an external amplifier also requires an external directional coupler. The coupling attenuation must be imported from the USB stick. The file has to be in ASCII format and must contain 3 columns separated by a comma. The first column is the frequency in Hz, the second represents the forward coupling attenuation and the last column is the reverse coupling attenuation. An example is shown below:

File name: Correction.factor.txt
10000,39.9,39.7
100000,39.9,39.7
30000000,39.9,39.8
100000000,40.3,40.2
1000000000,39.9,40.2

4.3.5. Setup —> Service

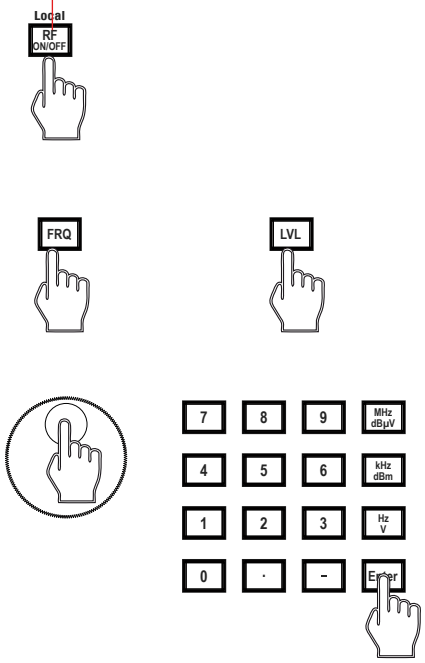
The “SERVICE MENU” is password protected and only accessible by authorized Teseq service personnel.

4.4. Power meter menu



The "POWER METER MENU" provides power meter readings (Channel 1 to 3) and also allows the display of the forward power (Amp out).

The internal power amplifier can be switched on/off with the softkey "AMP ON".



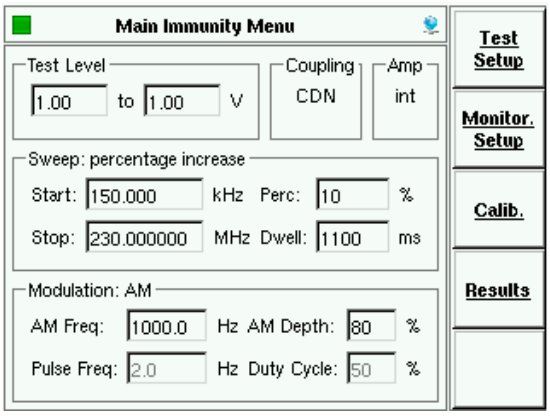
The generator can be switched on/off with the hardkey "RF ON/OFF".

The generator frequency and level can also be set of the generator. The hardkey "FRQ" allows the user to change the test frequency with the rotary knob (see chapter 4.1.5.4 for changing the step size) or the numeric keyboard.

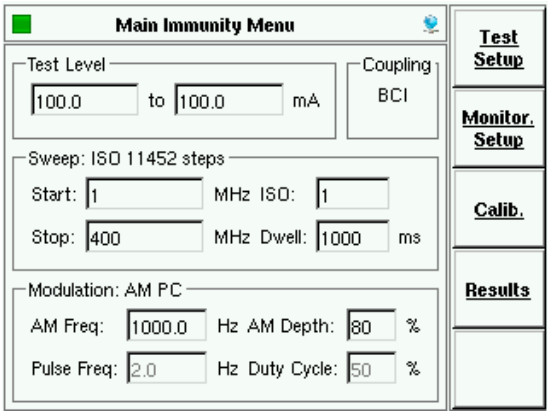
The hardkey "LVL" allows the user to change the test level with the rotary knob or the numeric keyboard.

The numeric input has to be terminated with the hardkey "ENTER" or with the specified unit key "MHz/dbµV", "kHz/dBm" or "Hz/V". The accepted value is displayed with green background color for a short while.

4.5. Immunity menu

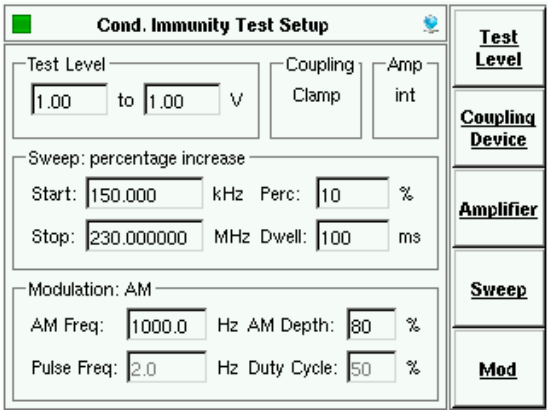


The "MAIN IMMUNITY MENU" gives an overview of the test parameters. The example shows IEC/EN 61000-4-6 test parameters through a selected coupling device: CDN, EM-clamp, CIP or direct coupling in the menu "COUPLING DEVICE".



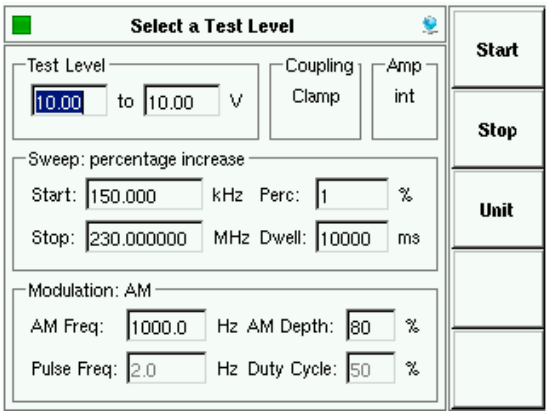
This example shows BCI test parameters through a selected coupling device: BCI in the menu "COUPLING DEVICE"..

4.5.1. Immunity menu —> Test Setup



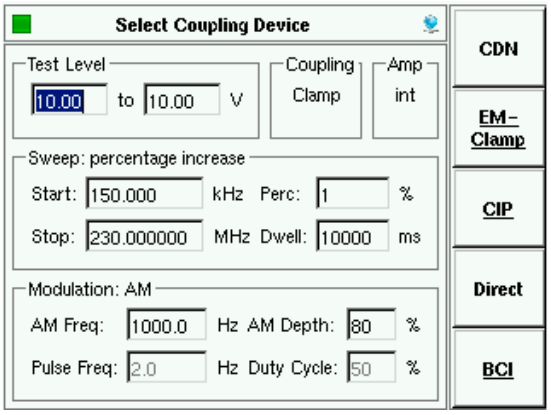
The test parameters can be set in the "CONDUCTED IMMUNITY TEST SETUP".

4.5.1.1. Immunity menu —> Test setup —> Test level



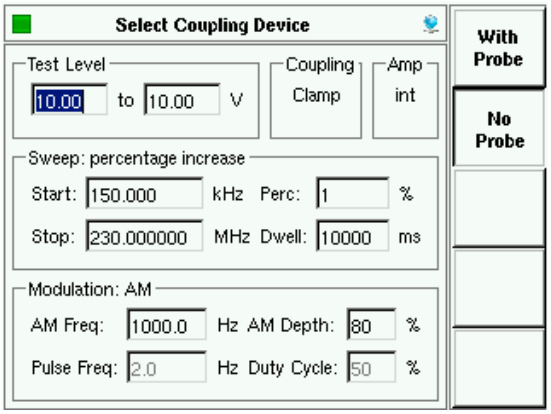
The start and stop level can be set in the "SELECT A TEST LEVEL" setup. The softkey "UNIT" is only active for BCI. Then the "UNIT" menu provides a choice of using units of mA or dBµA.

4.5.1.2. Immunity menu —> Test setup —> Coupling device



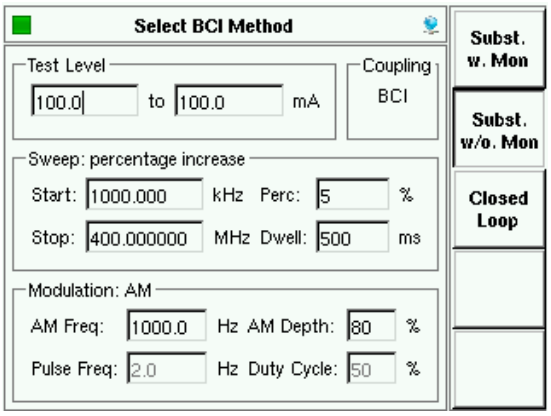
"SELECT COUPLING DEVICE" allows the user to choose a CDN, EM-clamp, current clamp (CIP) or direct injection according to IEC/EN 61000-4-6. The test level units are switched to Volts EMF.
The selection "BCI" switches the unit to current as required for Automotive tests.

4.5.1.2.1. Immunity menu —> Test setup —> Coupling device —>EM-clamp or —>CIP



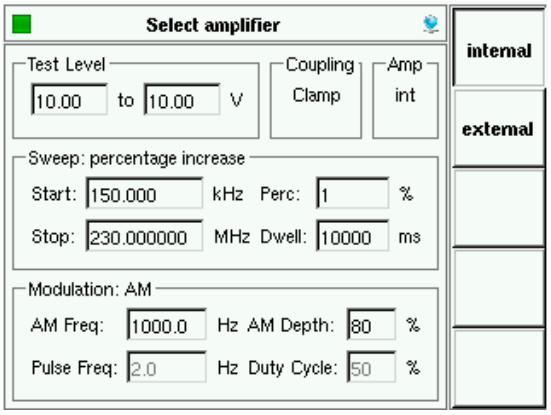
The user can choose whether or not to test with a monitoring current probe in the path to the EUT. The operation "WITH PROBE" requires a loaded probe calibration file in addition to the probe.
The function of the current probe is in relation to IEC/EN 61000-4-6.

4.5.1.2.2. Immunity menu —> Test setup —> Coupling device —>BCI



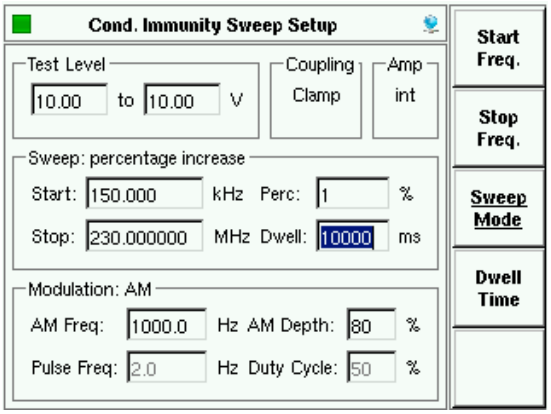
"SELECT BCI METHOD" allows the user to choose Substitution method with or without a monitoring current probe, or Closed loop method. Methods are based on ISO 11452-4.
The operation "WITH PROBE" using Closed loop method requires a probe in the path to the EUT and a loaded probe calibration file.
Using Substitution method with a current probe allows the user to obtain additional, useful information during testing and investigating. No test level limitation takes place.
The Closed loop uses a power limitation factor that can be set in Main —> Setup —> BCI settings.

4.5.1.3. Immunity menu —> Test setup —> Amplifier



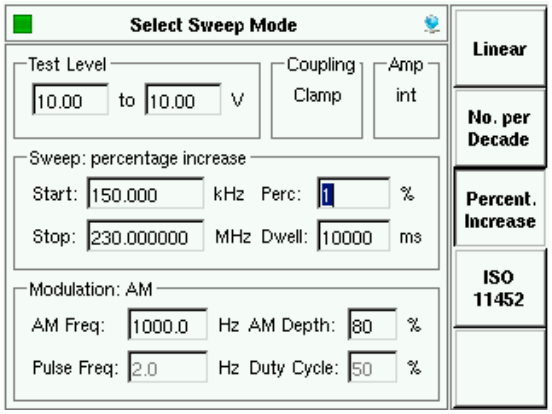
"SELECT AMPLIFIER" allows the user to select an internal or external power amplifier.

4.5.1.4. Immunity menu —> Test setup —> Sweep



Start and stop frequency, sweep mode and dwell time can be set in the "CONDUCTED IMMUNITY SWEEP SETUP".

4.5.1.4.1. Immunity menu —> Test setup —> Sweep —> Sweep mode

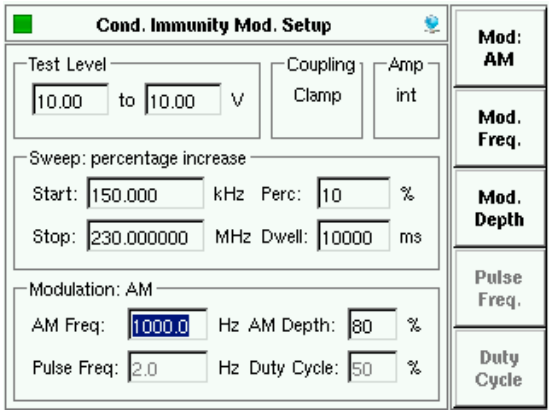


"SWEEP MODE" can be set to linear, numbers per decade or percent increase of the frequency. The option ISO 11452 allows the frequency increase as shown in ISO 11452-1. An additional parameter can be set between 1 and 100 to reduce the step size. See table below.

Frequency range in MHz	max. Step size in MHz according ISO 11452-1	Step size in MHz NSG 4070 parameterset to 1	Step size in MHz NSG 4070 parameterset to 2	Step size in MHz NSG 4070 parameterset to 10	Step size in MHz NSG 4070 parameterset to 100
0.01 to ≤ 0.1	0.01	0.01	0.005	0.001	0.0001
> 0.1 to ≤ 1	0.1	0.1	0.05	0.01	0.001
> 1 to ≤ 10	1	1	0.5	0.1	0.01
> 10 to ≤ 200	2	2	1	0.2	0.02
> 200 to ≤ 1000	20	20	10	2	0.2

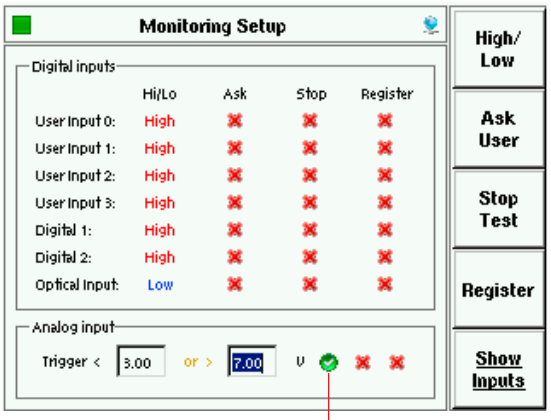
Table 1: Step size according ISO 11452-1

4.5.1.5. Immunity menu —> Test setup —> Modulation



Modulation can be set to AM, AM PC, pulse modulation, external modulation or off. The modulation can be changed by pressing the upper softkey.
AM: amplitude modulation
AM PC: amplitude modulation with peak conversation as described in ISO 11452-1
PM: pulse modulation
Ext.: external modulation
The modulation frequency can be in the range of 1 Hz to 50 kHz.
The AM modulation depth can be set between 0 and 100%.
The duty cycle can be set between 10% and 90%.

4.5.2. Immunity menu —> Monitoring setup



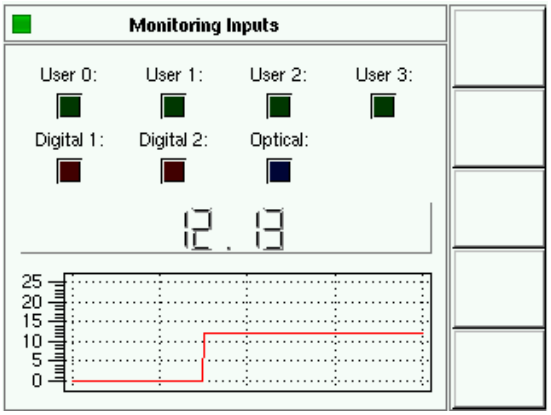
There are several EUT monitoring ports:

- Analog input 0-24 V
- Digital input 1 up to 24 V
- Digital input 2 up to 24 V
- Optical input
- User port (4 bit TTL in)

Each monitoring port can be individually configured. The switching condition can be set to high or low active using the softkey "HIGH/LOW". For analog input a window can be defined which can be used as a threshold or tolerance window.
The action in case of a trigger event (EUT failure) can be set either to register the occurrence of the event (lowest priority), to stop the test, or user decision (highest priority) using the corresponding softkeys. "STOP TEST" automatically includes the registration of the event; "ASK USER" allows the user to stop or continue the test.

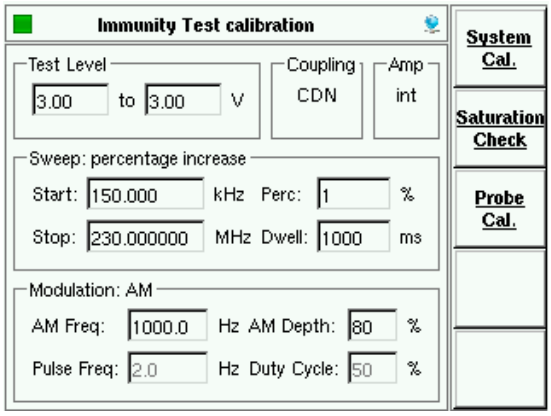
- **A green tick indicates that the monitoring port is enabled, a red cross a disabled port.**
  - ✓ **selected**
  - ✗ **not in use**

4.5.2.1. Immunity menu —> Monitoring setup —> Show inputs



This setup shows each monitoring state. The color of each box indicates high or low. The analog port voltage is displayed below the boxes. The graph shows a 10 second history of input activity.

4.5.3. Immunity menu —> Calibration

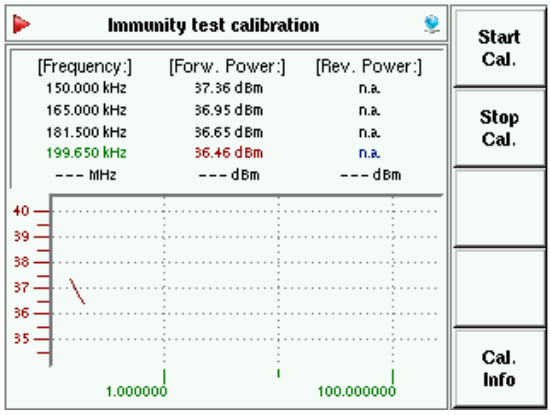


Two types of calibration can be performed:

- system calibration for the entire setup
- probe calibration for the monitoring probe.

The "SATURATION CHECK" function allows the user to test the necessary power reserve for the testing with modulation.

4.5.3.1. Immunity menu —> Calibration —> System calibration

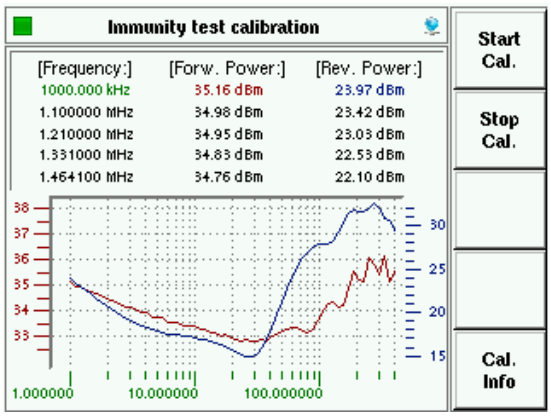


During calibration the current frequency and forward power are displayed in the table as well as in the graph. The reverse power is displayed when an external amplifier is selected.

The internal control algorithm provides a maximum deviation of ± 0.1 dB to the target calibration level. The NSG 4070 should be allowed a minimum warm up time of 10 minutes a warm up time of at least 10 min before performing calibration or testing.

The start frequency, stop frequency, test level, step mode, internal or external amplifier have to be defined in the "TEST SETUP" menu before calibration.
The calibration is independent of the selected dwell time and modulation parameters.

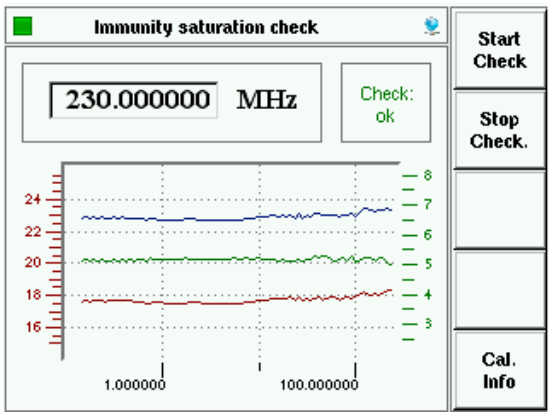
The softkey "START" starts the calibration and "STOP" terminates the calibration.



The calibration result can be observed by turning the rotary knob.
The red curve shows the forward power of the calibration which is related to the left axis. The blue curve shows the reverse power (only with external amplifier) of the calibration which is related to the right axis.

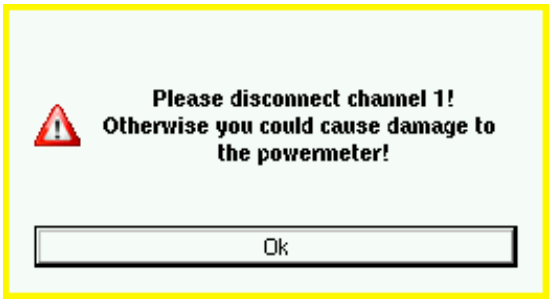
The softkey "CAL. INFO" provides the file name, start frequency, stop frequency, steps, start level, stop level and amplifier internal or external. An example is shown to the left.

4.5.3.2. Immunity menu —> Calibration —> Saturation check



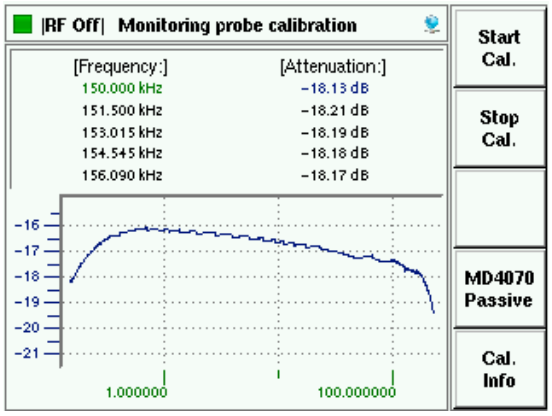
This function allows the user to check whether there is sufficient power available for the selected modulation required, even if the system calibration is always performed without modulation. Special high test levels could bring the power amplifier into saturated range if the modulation (e.g. AM with 80% needs 5.1 dB more power) is switched on during EUT testing. The check requires a loaded calibration file. The forward power of the calibration is increased with 5.1 dB during the check.
The result of the "SATURATION CHECK" is provided in a graph. The lower curve shows the calibration level in red. The upper curve shows the increased forward power during the check. Both curves are related to the left axis. The green curve shows the check result and is related to the right axis. For having the power reserve the check result should be around 5.1 dB.

The softkey "START" starts the check and "STOP" terminates the check. The softkey "CAL. INFO" provides the file name, start frequency, stop frequency, steps, start level, stop level and internal or external amplifier. An example is in chapter 4.5.3.1..



The forward power of the calibration is increased by 5.1 dB during the check. This could damage the power meter channel 1. It is strongly recommended to disconnect the power meter channel 1 for the "SATURATION CHECK". A message box, shown on the left side, reminds the user to follow this advice.

4.5.3.3. Immunity menu —> Calibration —> Probe calibration



The "PROBE CALIBRATION" function allows the user to calibrate a current probe in a 50 Ω jig. During the calibration the current frequency and attenuation are displayed in the table as well as in the graph.
The start frequency, stop frequency, step mode, internal or external amplifier have to be defined in the "TEST SETUP" menu before calibration.
The calibration is independent of the selected test level, dwell time and modulation parameters.
The "MONITORING PROBE CALIBRATION" function can also be used for checking the setup, cable or attenuator.

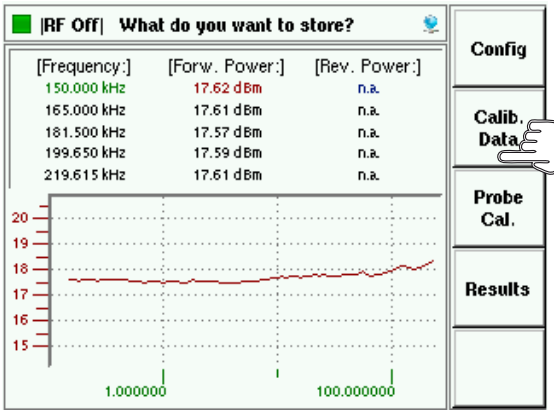
The softkey "START" starts the calibration and "STOP" terminates the calibration.

The softkey "MD 4070 PASSIVE"/ "MD 4070 ACTIVE" allows the user to switch the probe to passive or active mode if connected (cable LE 242) with the user port of the NSG 4070.

The softkey "CAL. INFO" provides the file name, start frequency, stop frequency and steps. An example is shown on the left side.

4.5.3.4. Immunity menu: Store and recall calibration data

In general, the hard keys “STO” and “RCL” allow the user to store and to recall configurations, calibration data, probe calibration and results.

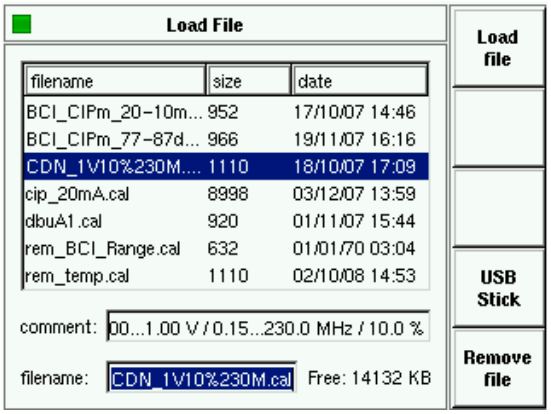


Store
Pressing the hard key “STO” followed by the soft key “CALIB. DATA” allows the user to save the calibration results of the test setup to the internal flash or USB stick as file type “.cal”.

Included in the calibration file are:

- Start and stop frequency
- Start and stop level
- Amplifier internal/external
- Forward power versus frequency
- “FILE COMMENT”

The file comment offers additional information to the calibration file and can be filled out before saving the file.



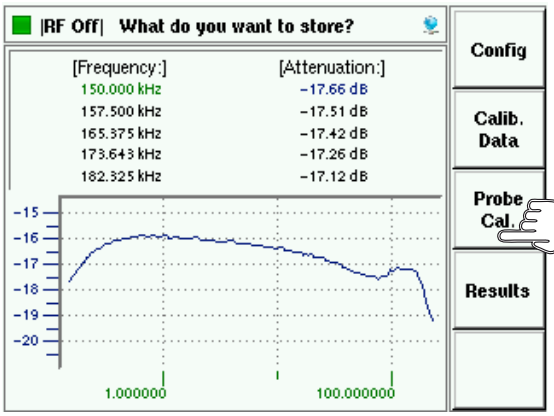
Recall
Pressing the hard key “RCL” followed by the soft key “CALIB. DATA” allows the user to recall the calibration results of the test setup from the internal flash or USB stick.

The stored file can be selected by turning the rotary knob.

Attention: The recall of calibration data overwrites the parameters for test level and amplifier use (internal /external).

4.5.3.5. Immunity menu: Store and recall probe calibration data

In general the keys “STO” and “RCL” allow the user to store and recall the configurations, calibration data, probe calibration and results.

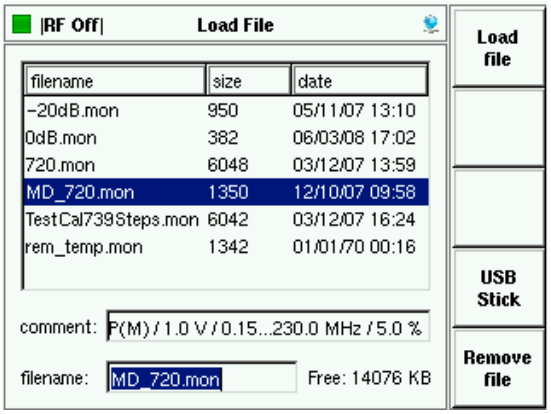


Store
Pressing the hard key “STO” followed by the soft key “PROBE CAL.” allows the user to save the probe calibration results to the internal flash or USB stick as file type “.mon”.

The probe calibration file includes:

- Start and stop frequency
- Frequency step information
- Insertion loss versus frequency
- “FILE COMMENT”

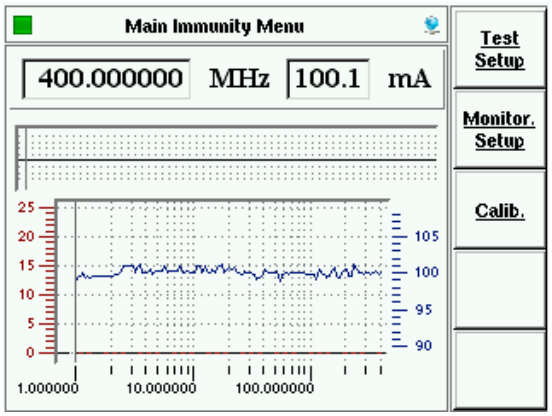
The file comment provides additional information relating to the calibration file and can be filled out by the user before saving the file.



Recall
Pressing the hard key “RCL” followed by the soft key “PROBE CAL.” allows the user to recall the probe calibration results from the internal flash or USB stick

The stored file can be selected by turning the rotary knob.

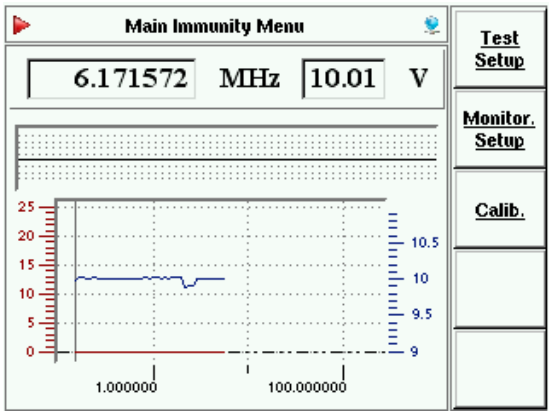
4.5.4. Immunity menu —> Results



The softkey "RESULTS" shows the current test result which can be investigated by turning the rotary knob.
The blue curve shows the test level on which the calibration is based, and is related to the right axis.
The red curve shows the voltage on the analog EUT monitoring input, and is related to the left axis. Other EUT monitoring events are displayed above the graph with different colors.

The softkeys "TEST SETUP", "MONITORING SETUP" and "CALIBRATION" are described previously and can also be reached with the softkey "BACK".

4.5.5. Immunity menu: Testing



The hardkey "RUN/STOP" allows the user to start the current test independent of the menu selected within the immunity mode.
Pre-conditions:

- loaded system calibration
- selected EUT monitoring functions
- disconnected power meter 1 for testing above 18 V EMF stress level from the calibration setup

During the test the current frequency, test level and trigger events / analog input voltage on EUT monitoring ports are displayed. The analog input voltage (red curve) is related to the left axis. The test level (blue curve) is related to the right axis.

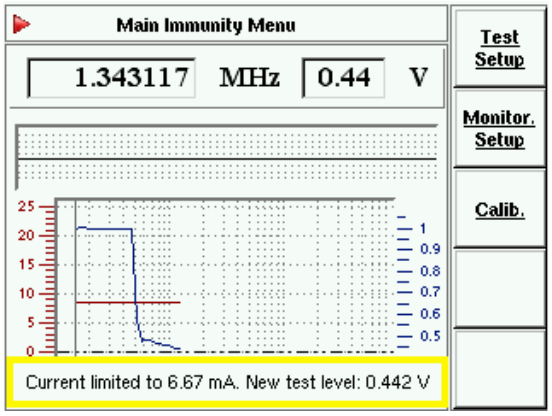
The internal control algorithm provides a maximum deviation of ± 0.1 dB to the used calibration values.

The hardkey "RUN/STOP" allows the user to stop the executed test.

The results can be investigated by turning the rotary knob after the test is finished or aborted.

The softkeys "TEST SETUP", "MONITORING SETUP" and "CALIBRATION" are described previously and can also be reached with the softkey "BACK".

4.5.5.1. Immunity menu: Testing with monitoring probe



Testing with a monitoring probe requires a coupling device such as an EM clamp, CIP or BCI with one of the following parameters selected: "WITH PROBE" or "SUBSTITUTION WITH MONITORING DEVICE" (for BCI) or "CLOSED LOOP".

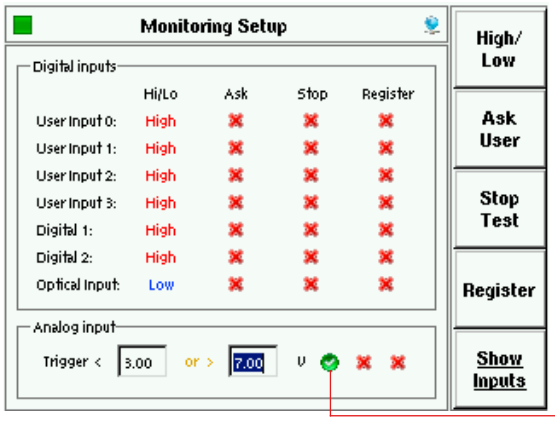
The user must recall a probe calibration file as well as the system calibration file. (chapter 4.5.3.5)

Pre-conditions:

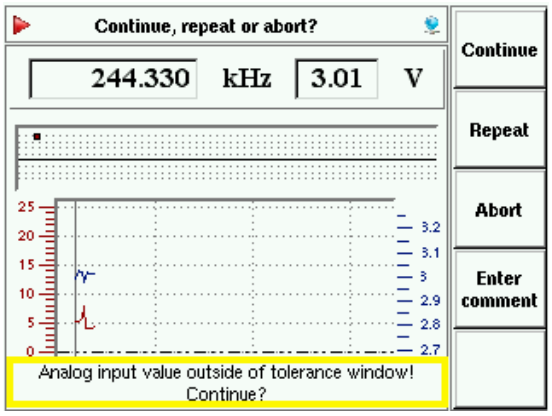
- system calibration loaded
- probe calibration loaded
- EUT monitoring functions selected
- monitor probe on power meter 1 connected

IEC/EN 61000-4-6 requires a limitation of the stress level if the requirements for the asymmetrical impedance cannot be fulfilled. A reduced stress level can be recognized as variance from the standard test level as shown in the blue curve. The test level (blue curve) is related to the right axis.

4.5.5.2. Immunity menu: Testing with EUT monitoring events

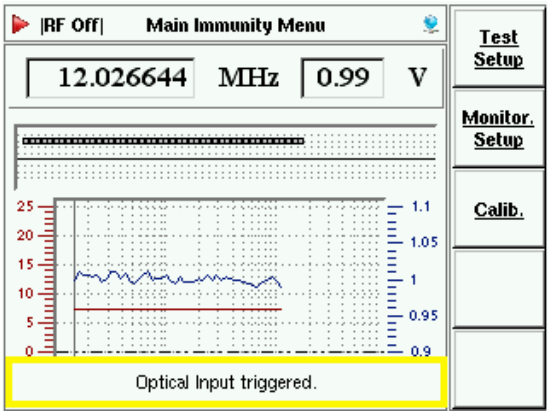


The action in case of a trigger event (EUT failure) can be set either to register the occurrence of the event (lowest priority), to stop the test, or user decision (highest priority) using the corresponding softkeys (see chapter 4.5.2 for details).



- If "ASK USER" is selected and an EUT monitoring event occurs:

A message box and softkeys come up during the test when the EUT monitoring event has been detected.
The test is interrupted.
Press "CONTINUE" to continue testing.
Press "REPEAT" to repeat testing on same frequency.
Press "ABORT" to stop the test.
Press "ENTER COMMENT" to type in a comment.



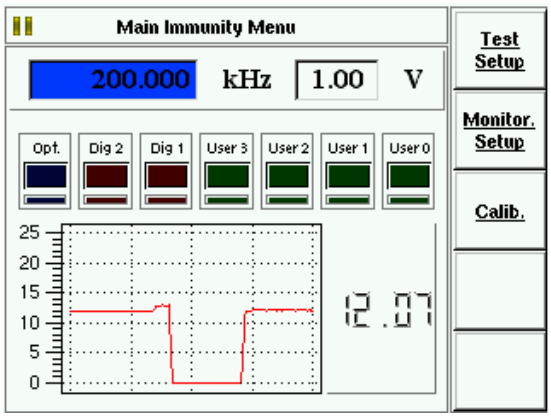
If “REGISTER” is selected, when an EUT monitoring event occurs:
A message box is displayed when the EUT monitoring event has been detected. The test continues.

If “STOP THE TEST” is selected, when an EUT monitoring event occurs:
A message box is displayed when the EUT monitoring event has been detected. The test is terminated.

4.5.5.3. Immunity menu: Testing with manual change of frequency and level

The key "RUN/STOP" allows the user to start the current test and the key "HOLD" interrupts the sweep and the display is changed as shown below:
Pre-conditions:

- system calibration loaded
- probe calibration loaded (all test with monitoring device)
- EUT monitoring functions selected
- power meter 1 for testing above 18 V EMF stress level disconnected



During this mode each monitoring port state is displayed. The color indicates high or low. The smaller field shows the history for the past 5 seconds.
The analog port voltage is displayed with the digits. The graph shows the past 10 seconds of history.

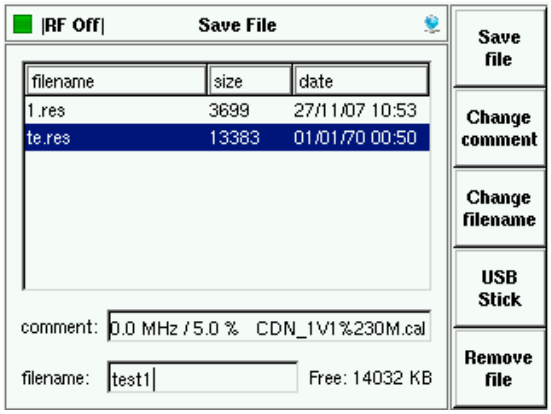
The hardkey "FRQ" allows the user to change the test frequency by the rotary knob. Only the calibrated frequencies can be selected. The hardkey "LVL" allows the user to change the test level with the rotary knob.

The use of the key "HOLD" continues the sweep. The display changes to the previous one.
The key "RUN/STOP" allows the user to stop the test.

Warning: **The function "HOLD" interrupts only the sweep. The test level is still present on the output.**

4.5.5.4. Immunity menu: Store and recall results

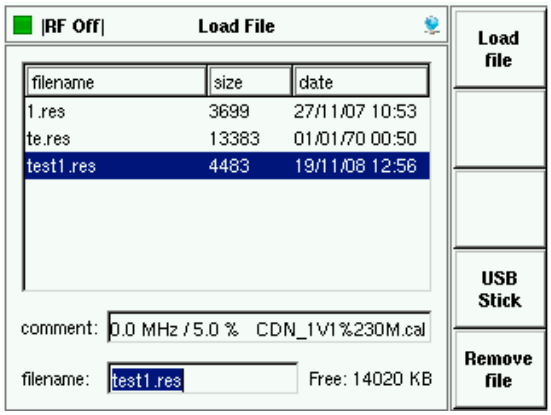
In general the keys "STO" and "RCL" allow the user to store and recall the configurations, calibration data, probe calibration and results.



Store
Pressing the hard key "STO" followed by the softkey "RESULTS" allows the user to save the test results (including test setup and calibration data) to the internal flash or USB stick as file type ".res".

The results file includes:

- Start and stop frequency
- Start and stop level
- Sweep parameters
- Coupling device and monitoring probe
- Modulation parameters
- Amplifier internal/external
- EUT monitoring settings
- Forward power versus frequency (calibration data)
- Insertion loss versus frequency (probe calibration data) if probe used
- "FILE COMMENT"



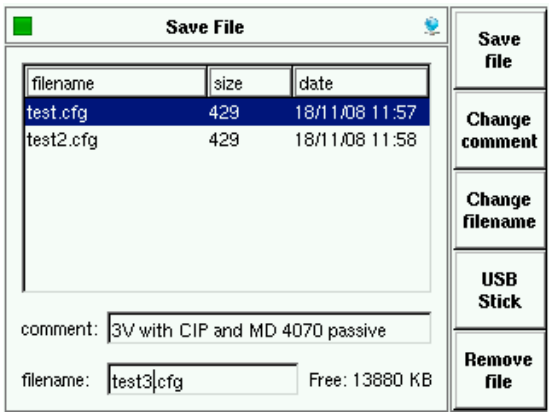
"CHANGE COMMENT"
The file comment allows the user to add information to the results and can be filled out before saving the file.

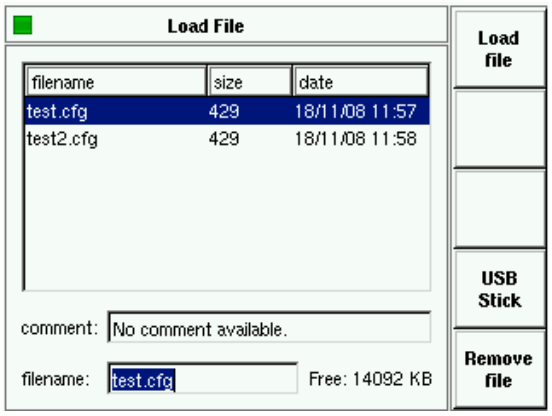
Recall
Pressing the hard key "RCL" followed by the softkey "RESULTS" allows the user to recall the results from the internal flash or USB stick.

The stored file can be selected by turning the rotary knob.

4.5.5.5. Immunity menu: Store and recall configurations

In general the keys "STO" and "RCL" allow the user to store and to recall the configurations, calibration data, probe calibration and results.





Store
Pressing the hard key "STO" followed by the softkey "CONFIG" allows the user to save the test configuration to the internal flash or USB stick as file type ".cfg".

The configuration file includes:

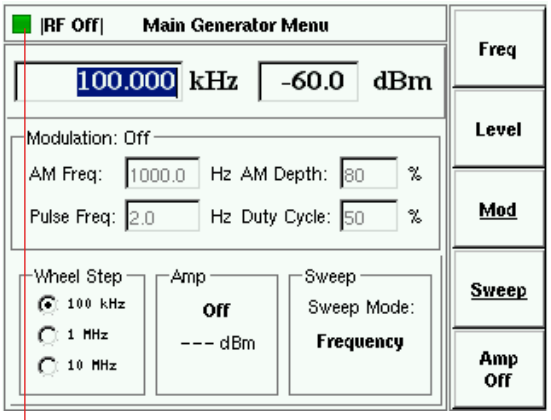
- Remote settings
- Generator mode settings
- Step key settings
- Start and stop frequency
- Start and stop level
- Sweep parameters
- Coupling device and monitoring probe
- Modulation parameters
- Amplifier internal/external
- EUT monitoring settings
- "FILE COMMENT"

"CHANGE COMMENT"
The file comment allows the user to add information to the configuration file and can be filled out before saving the file.

Recall
Pressing the hard key "RCL" followed by the softkey "CONFIG" allows the user to recall the configuration from the internal flash or USB stick.

The stored file can be selected by turning the rotary knob.

4.6. Generator menu



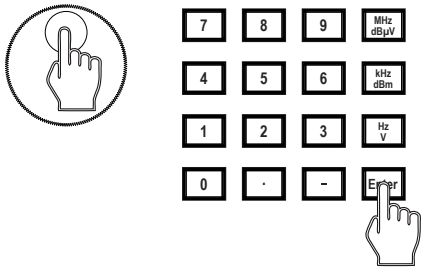
The generator menu gives an overview about the current settings of the signal generator.

Frequency and level can be set by hard keys or by softkeys in this menu.

The generator can be switched on/off with the hard key "RF ON/OFF".

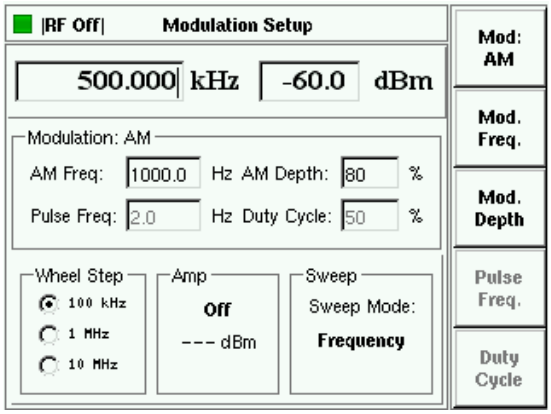
The hard key "FRQ" allows the user to change the frequency by the rotary knob (see chapter 4.1.5.4 for changing the step size) or the numeric keyboard.

The hard key "LVL" allows the user to change the test level with the rotary knob or the numeric keyboard.



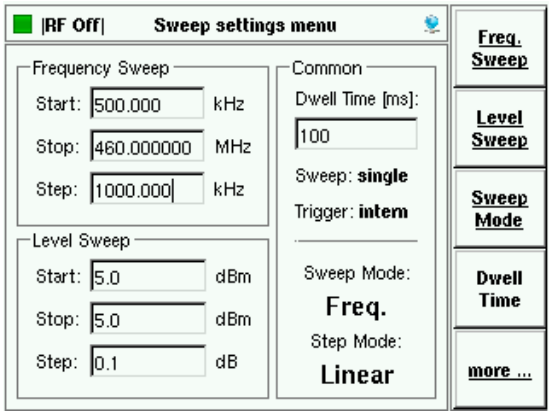
Numeric input must be terminated with the hard key "ENTER" or with the specified unit key "MHz/dbµV", "kHz/dBm" or "Hz/V". The accepted value is displayed with green background color for a short time.

4.6.1. Generator menu —> Modulation

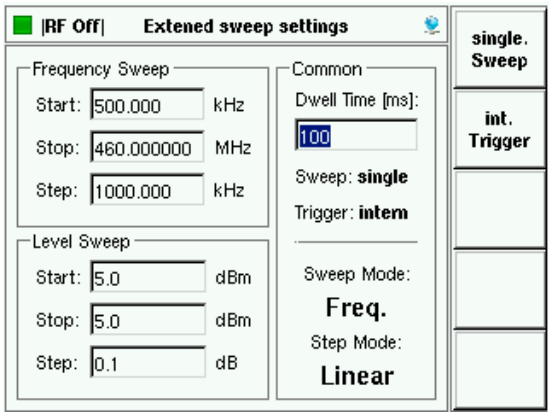


Modulation can be set to AM, pulse modulation, external modulation or off. The modulation can be changed by pressing the upper softkey.
AM: amplitude modulation
PM: pulse modulation
Ext.: external modulation
The modulation frequency can be in the range of 1 Hz to 50 kHz.
The AM modulation depth can be set between 0 and 100%.
The duty cycle can be set between 10% and 90%.

4.6.2. Generator menu —> Sweep

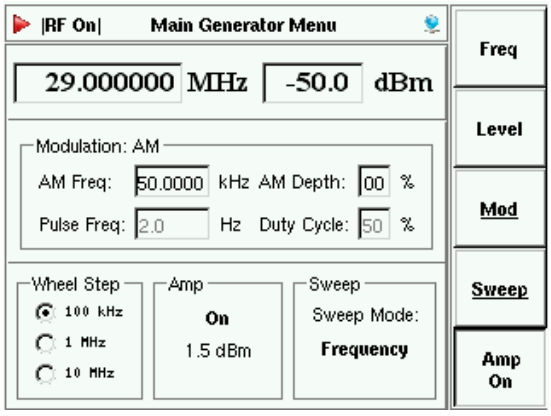


Start and stop frequency, sweep mode and dwell time can be set in the sweep setup. The desired sweep mode must be selected in the sweep mode menu.



Extended sweep settings are available in the submenu "MORE".
In this menu the user can press a softkey to select Single or Continuous sweep. The trigger can be set by softkey to either Internal (next step occurs automatically after the dwell time) or External (next step after trigger signal occurs at the external trigger input). The External trigger setting requires a connection to the trigger input on the NSG 4070 back panel.

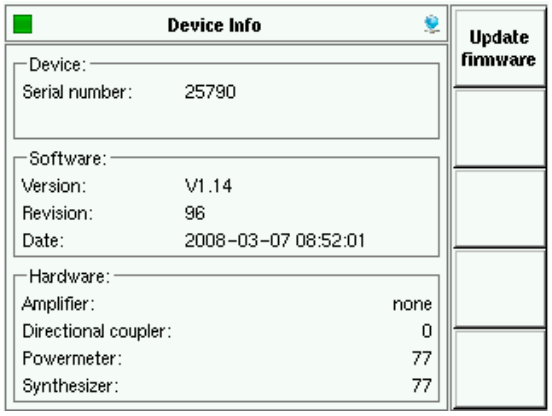
4.6.3. Generator menu —> Amplifier



Every NSG 4070 model except the 4070-0 includes an internal amplifier. The amplifier is turned on by pressing the softkey "AMP ON" in the Main Generator menu. The drive level, or signal generator output level, is limited to 0 dBm when the amplifier is in use. The amplifier output level (non-calibrated) and the signal generator level (amplifier module drive level) are displayed.

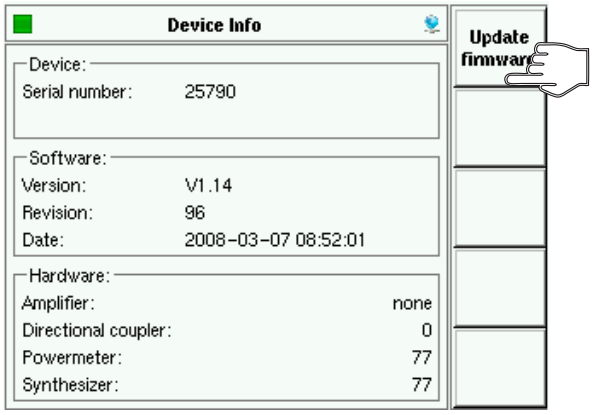
WARNING: The power meter inputs are very sensitive. Please avoid any direct connection of amplifier output and power meter input with a high generator level (under these circumstances a maximum generator level of -30 dBm is recommended).

4.7. Device info



"DEVICE INFO" gives general information about serial numbers of the internal components as well as firmware versions.

4.7.1. Info —> Update firmware



The softkey "UPDATE FIRMWARE" allows the user to update the firmware. The update file needs to be in the root directory of the USB stick.
The latest firmware is available from:
http://www.teseq.com/com/en/service_support/rf_software_support/software_downloads.php

5. NSG 4070 CONTROL PROGRAM

5.1. Introduction

The Windows-based NSG 4070 control program provides full remote control of the NSG 4070's generator and immunity mode, as well as providing a comprehensive test report function. Measured value graphics and measurement reports can be easily generated from the system's results (*.res) files via the control program.

5.2. Installation, deinstallation and licensing

5.2.1. System requirements

Operating system:	Windows 98 / 2000 / XP (Operation with Windows NT or Vista should be possible but not yet tested.)
Printer:	at least one installed printer
Screen resolution:	at least 800 x 600 (adjustable into system control/adjustings report// dissolving)
System document/display:	small scripts or 96 DPI (this is the windows standard adjustment) program also with 120 DPI executable, but then minor graphical inaccuracies are possible

5.2.2. Installation procedure

The NSG 4070 control program is supplied on the USB stick (NSG 4070 scope of delivery) for the installation under Microsoft Windows. Software updates are available from:
http://www.teseq.com/com/en/service_support/rf_software_support/software_downloads.php

The file "NSG4070_INST.EXE" is a self extracting file which is copied into a new, self created folder. The user can then execute the program "NSG4070_CTRLx.EXE" to initiate installation.

5.2.3. Uninstall

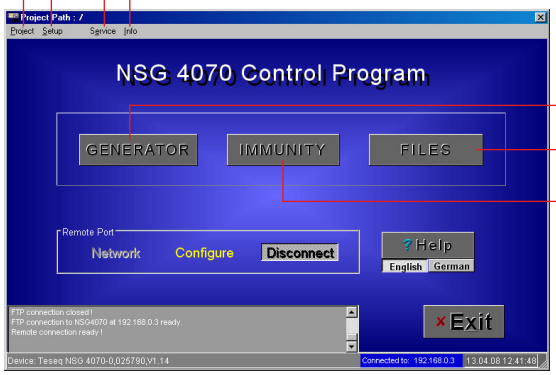
The program can be deleted directly without affecting the operating system. No Windows registry items are created during installation.

5.2.4. Licensing

The NSG 4070 control program has unlimited licenses to provide maximum flexibility in the laboratory.

5.3. Start Window

The program starts with the main window. The window offers access to the remote port settings as well as to the program settings and files menu. When connected, the generator or immunity menu can also be used.



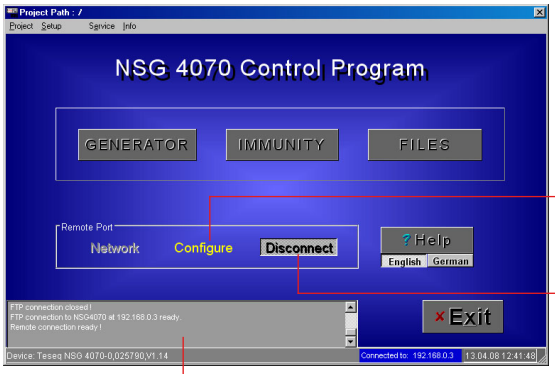
- A path for an individual project can be created or modified via "PROJECT" in the "MAIN MENU" of the window.
- The "SETUP MENU" item opens a window for various program default settings.
- A "DEMO MODE" of the program can be activated in the "SERVICE MENU". This mode provides access to the "GENERATOR" and "IMMUNITY" windows if the NSG 4070 is not connected. The following limitations apply in the demo mode:

  - calibration is not possible
  - access to the level editor for BCI measurements is provided, but sweeps are not possible
  - external monitoring events are not simulated (but operator key can be used)
- The "INFO MENU" provides the manufacture and program information.
- The "GENERATOR" window permits the separate control of the individual components of the NSG 4070 i.e. power meters, synthesizer and power amplifier.
- The "FILES" window offers:
  - Copying files between NSG 4070 and PC
  - Post-processing of the measurement results, in particular the insertion of comments for the complete file or at each frequency step
  - Graphical display of the measurement results and saving as *.jpg file
  - Examination of the measurement results with measurement cursor
  - Automatic generation of a test report
  - Generation of an ACSII-file with all test results
- The basic functions of the "IMMUNITY" window are:

  - Input of test parameters for IEC/EN 61000-4-6 and BCI testing
  - Test setup and probe calibration
  - Test execution with possible automatic threshold search or level sweep
  - Manual trigger using spacebar, manual threshold search
  - Graphical display of the test results and the monitoring ports with zoom function and numeric evaluation of the measurement results using a cursor
  - Input of comments for every frequency step during and after the measurement
  - Saving and recalling calibration and measurement results

5.4. Remote configuration

The NSG 4070 can be remotely controlled via an Ethernet (LAN), RS232 or a USB interface. However, the complete range of functions, particularly file transfer, are only available when using the Ethernet interface.

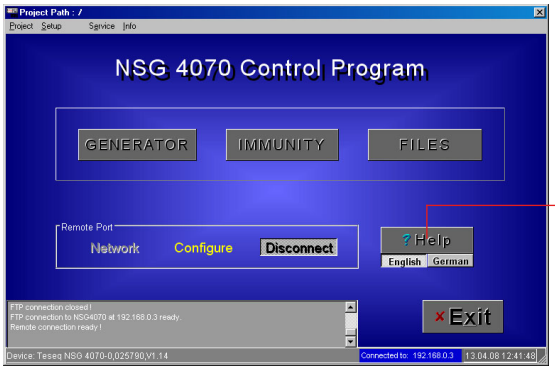


- **The selection of the remote control port is made in this field using the "CONFIGURE" button for the configuration of this port. There are three possible interfaces available:**
  - **Ethernet interface (recommended)**
  - **USB interface**
  - **RS232 interface**
- **The "CONNECT" button activates the remote control connection.**
- **If the connection to the NSG 4070 is successful, the following lines are displayed:**
  - **FTP connection to NSG 4070 at 192.168.xxx.xxx ready**
  - **Remote connection ready**

Warning: **We strongly recommend consulting the responsible administrator before integrating the NSG 4070 in a company network.**

Attention: **The NSG 4070 Control Program "HELP" function provides more information about the remote settings.**

5.5. Help function



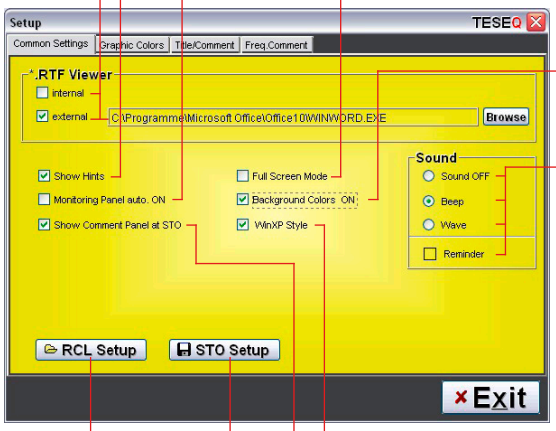
- **The "HELP" button provides comprehensive program information and user advice.**

Context-sensitive help can be invoked in every window using the "F1" key of the PC keyboard.

5.6. Setup window

5.6.1. General settings

There are functions in the "SETUP" window which change the behavior / appearance of other parts of the program.



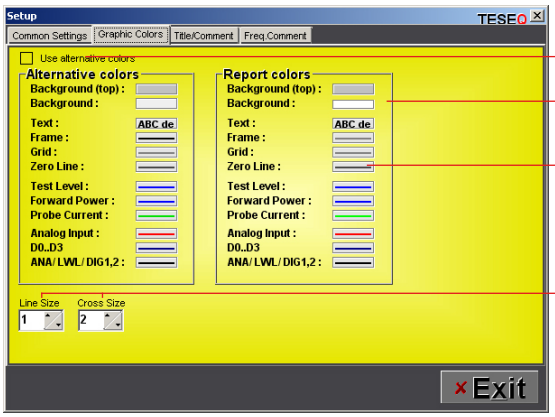
- **The user can select between an internal and an external viewer for displaying the test reports generated by the program. However, the internal viewer is only suitable for simple displays; for example, it cannot display multi-line table lines and graphs. If an external viewer is selected, an appropriate program (e.g. Microsoft Word) must be selected using the "BROWSE" button.**
- **In some places, hints are displayed when the mouse is moved over the control elements. This feature can be deactivated here.**
- **If activated, the panel for displaying the monitoring inputs is automatically displayed in the "IMMUNITY" window as soon as the cursor is positioned over the graphic of the test results.**
- **This mode uses the full screen. Changes apply after restarting the program.**
- **All program background colors can be deactivated and replaced with different shades of grey.**
- **A sound signal can be used to highlight the termination of a sweep as well as other program conditions.**

  The "REMINDER" highlights the termination of a test: every minute a beep, every 5 minutes a user-selectable *.wav file, and every 15 minutes three consecutive *.wav files.

  The desired *.wav files can be selected in the sound folder of the program or replaced by individual *.wav files.
- **The keys will appear in the standard Windows XP style, unless "classic" is selected in Win XP. Changes apply after restarting the program.**
- **The results can be saved as *.res files in the "IMMUNITY" window using the "STO" button. In doing so, the window modifying the comments contained in the file can optionally be displayed before the file dialogue for the file name input is displayed.**
- **Stores and recalls setup files of this program**

5.6.2. Graphic Colors

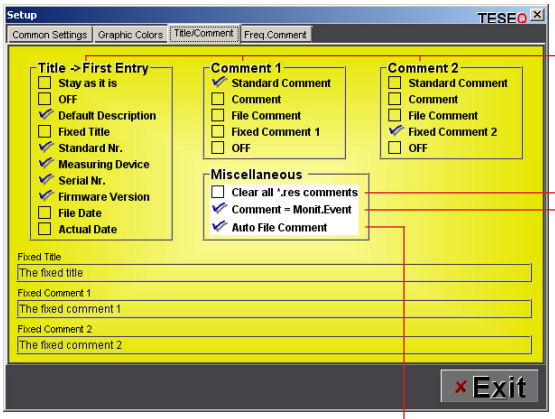
Under "GRAPHIC COLORS", it is possible to select an "ALTERNATIVE COLOR" palette for the measured value graphics and to change the respective colors. The report file graphics colors are defined in the "REPORT COLORS" area.



- **Activates an alternative color set**
- **Graphic color set for test report**
- **Click here to change colors**
- **Click to change line size and cross size of the graphical display**

5.6.3. Title/Comment

The program automatically inserts a title line and two comment lines in every graphic. The contents of these lines can be defined in the "TITLE/COMMENT" window, and each line can be suppressed using the "OFF" option.

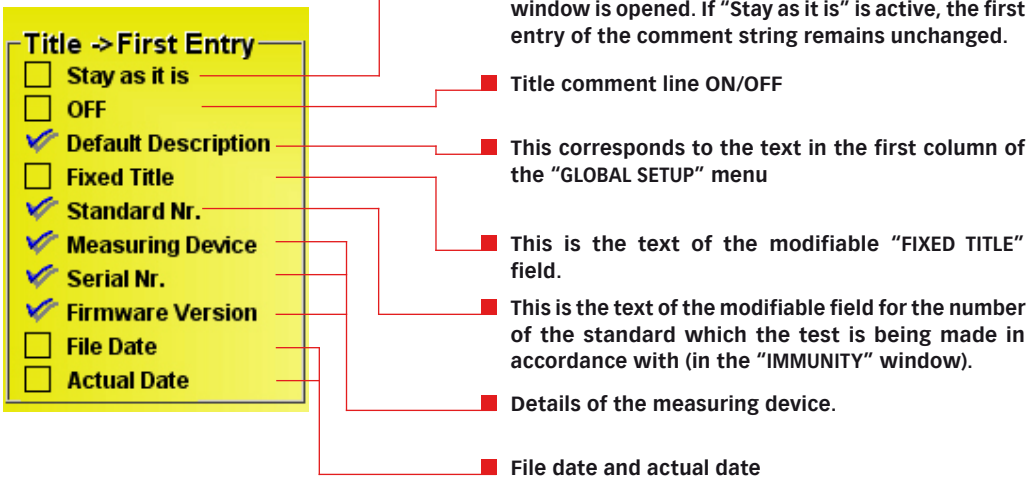


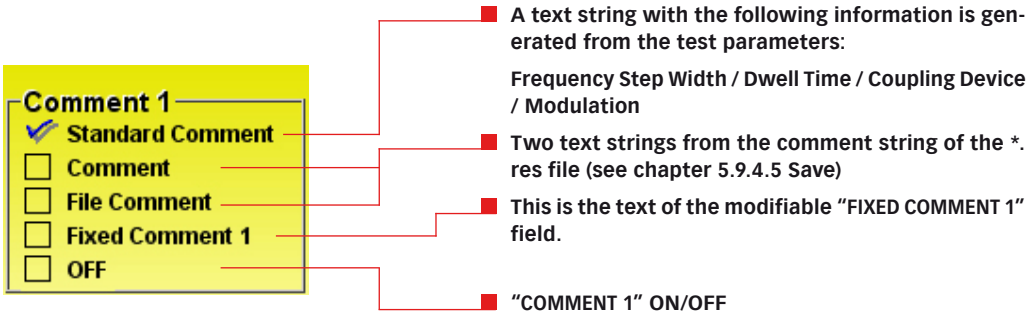
- **Pre- definitions for the corresponding lines in the test result graphic. Details are shown on the next page.**
- **All file comments are usually deleted at the start of each immunity measurement. This can be deactivated here and the previous comment string will be applied unchanged in the new *.res file. This does not affect the updating of 5 automatically generated comment entries.**
- **Comments can be inserted in the results of a test by the user at every test frequency irrespective of whether a monitoring event has occurred there or not. If "COMMENT=MONIT. EVENT" is activated, the program treats these inserted comments as monitoring events. This means that the frequencies with comments are also included when moving the cursor with the left / right step buttons; these frequencies also occur in the test report under the chapter "TRIGGER EVENTS".**
- **At the start of a test or a calibration the "FILE COMMENT LINE" of the result file is generated automatically. This string consists of the following parts:**

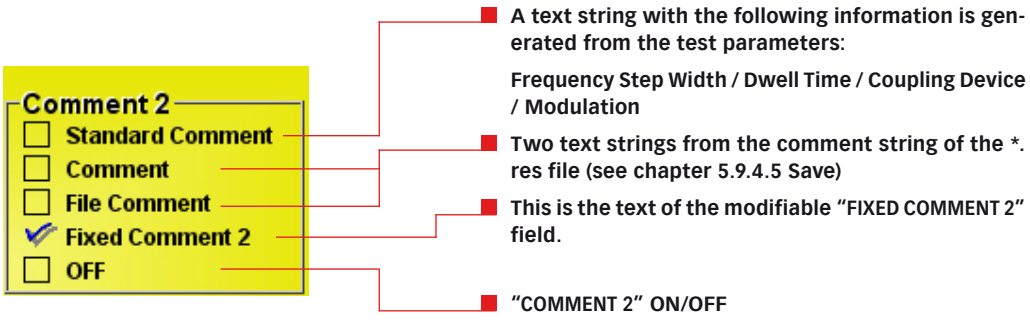
  ***.cal / *.mon files: Coupl.Device / Test Level / Startfr... Stopfr. / Step width**

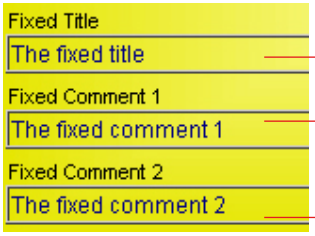
  ***.res files: Coupl.Device / Test Level / Startfr...Stopfr. / Step width / Calbr. Filename / Calbr. Level**

The configuration of the string for the title line of the graphics is made in the "TITLE->FIRST ENTRY" area. This string is also entered at the first position in the "Title" comments string which is saved together with the test results. This string is updated automatically after every test start; all substrings are concatenated with each other.









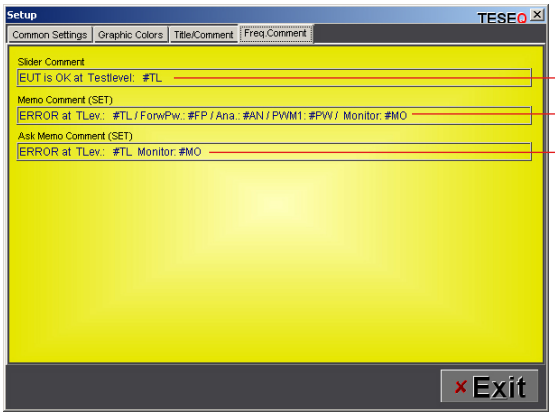
- **This is the text of the modifiable "FIXED TITLE" field.**
- **This is the text of the modifiable "FIXED COMMENT 2" field.**
- **This is the text of the modifiable "FIXED COMMENT 2" field.**

5.6.4. Frequency comments

A comment string can be introduced for each measurement value. Up to 3 comments can be predefined in the "FREQ. COMMENT" window in order to facilitate the commenting process. These comments can be defined in the "FREQ. COMMENT" window and can be used to comment the measurement data in the immunity window using the corresponding softkeys.

Furthermore, templates can be used in the standard comments. These templates will be replaced by the current corresponding test values. The following templates are available:

#FR	frequency
#TL	test level
#FP	forward power
#AN	analog input voltage (monitoring)
#PC	monitoring probe current
#PW	power meter ch 1, ch 2 or ch 3
#MO	monitoring event



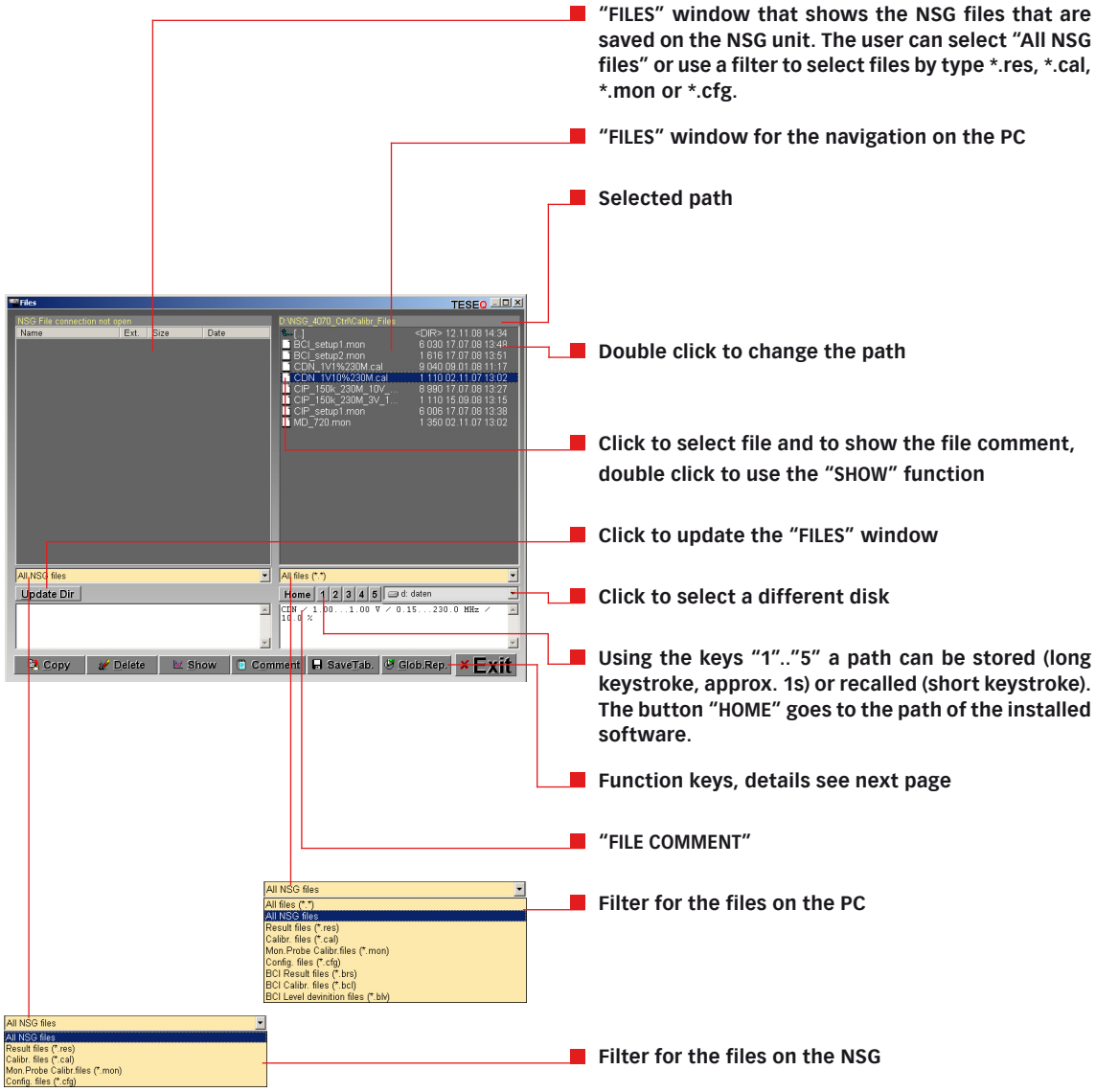
- **Double clicking the slider inserts this string into the "MEMO FIELD" bottom left.**
- **The "MEMO COMMENT (SET)" is allocated to the "SET" key in the "MEMO FIELD" bottom left.**
- **The "ASK MEMO COMMENT (SET)" is allocated to the "SET" key of the "ASK USER" window which appears in case of a monitoring event if the "ASK" option is activated**

5.7. File window

Functions for the conversion, the graphical display, the modification of comments and the creation of test reports are available in this window. However, these functions can only be applied to files which are already on the PC. This means the measured value files must have previously been transferred to the PC using the "COPY" function or the USB stick.

Files can be copied and deleted using two file selection windows, one on the left for the files on the NSG 4070 and one on the right for the files on the PC. When a file is selected, its file comment ("FILE COMMENT") is displayed automatically in one of the bottom message windows. The file comment can be changed in the "COMMENT" window (see chapter 5.9.4.5 Save).

Note:
The NSG 4070 window (left part of the "FILES" window) can be used only with active remote control via the "Network" port.



Advanced Test Solutions for EMC

Function keys

The desired program functions are initiated using the function keys on the lower part of the screen. Except for "COPY" and "DELETE", these program functions are limited to specific file types (this is shown in the respective tool tips). The file or group of files to be processed must be selected in one of the two file windows using the mouse or shift + cursor key (PC keyboard) before using a function key.

Only the "Copy" and "Delete" functions can be used for the files in the NSG 4070 file window while all functions are available in the PC file window.

Press the "COPY" button to copy files from the NSG to the PC or from the PC to the NSG.

Alternative: File copy can also be done with drag & drop. Left mouse key for file selection and right mouse key for drag & drop.

Press the "DELETE" function, press this button to delete files.

The "SHOW" window contains the graphical display of the test or calibration data. See chapter 5.7.1 for details.

"COMMENT" invokes the window for modification of the file comment. See chapter 5.9.4.5 for details.

"SAVE TAB." creates an ASCII-file with all data of a *.res or a *.cal file and opens a file dialogue for saving.

"GLOB.REP." opens a window for selecting a report template file and for generation of the test report See chapter 5.9.4.6 for details.

Frequency	Test Level		Forward Power		Probe Current	Ana.Mon.Input
0.150000	9.92	44.56	0.00	0.000	-100.00	x
0.157500	10.00	44.48	0.00	0.000	-100.00	x
0.165375	10.10	44.32	0.00	0.000	-100.00	x
0.173643	10.09	44.14	0.00	0.000	-100.00	x
0.182325	10.08	44.05	0.00	0.000	-100.00	x
0.191441	10.08	43.88	0.00	0.000	-100.00	x
0.201013	10.06	43.74	0.00	0.000	-100.00	x
0.211063	10.10	43.61	0.00	0.000	-100.00	x
0.221616	10.00	43.42	0.00	0.000	-100.00	x
0.232696	10.06	43.33	0.00	0.000	-100.00	x
0.244330	10.08	43.22	0.00	0.000	-100.00	x
0.256546	10.10	43.03	0.00	0.000	-100.00	x
0.269373	10.04	42.93	0.00	0.000	-100.00	x
0.282841	10.05	42.80	0.00	0.000	-100.00	x
0.296983	10.04	42.69	0.00	0.000	-100.00	x
0.311832	10.05	42.49	0.00	0.000	-100.00	x
0.327423	10.04	42.34	0.00	0.000	-100.00	x
0.343794	9.99	42.22	0.00	0.000	-100.00	x
0.360983	10.01	42.12	0.00	0.000	-100.00	x
0.379032	10.02	42.00	0.00	0.000	-100.00	x
0.397983	10.02	41.90	0.00	0.000	-100.00	x
0.417882	10.02	41.68	0.00	0.000	-100.00	x
0.438776	10.02	41.58	0.00	0.000	-100.00	x
0.460714	10.02	41.49	0.00	0.000	-100.00	x
0.483749	10.03	41.40	0.00	0.000	-100.00	x
0.507936	10.03	41.30	0.00	0.000	-100.00	x
0.533332	9.99	41.20	0.00	0.000	-100.00	x
0.559998	10.11	41.11	0.00	0.000	-100.00	x
0.587997	10.03	41.04	0.00	0.000	-100.00	x
0.617396	10.03	40.93	0.00	0.000	-100.00	x
0.648265	10.02	40.81	0.00	0.000	-100.00	x
0.680678	10.02	40.69	0.00	0.000	-100.00	x
0.714711	10.00	40.58	0.00	0.000	-100.00	x
0.750446	10.02	40.57	0.00	0.000	-100.00	x
0.787968	10.00	40.45	0.00	0.000	-100.00	x
0.827366	10.03	40.33	0.00	0.000	-100.00	x

Example of a *.res file converted to ASCII

5.7.1. Show window

The "SHOW" window contains the graphical display of the test or calibration data. The following functions are available here:

- Frequency and level zoom
- Measurement cursor for the display of the test data and monitoring events
- Adding and changing a comment string for every test frequency
- Changing the comments contained in the graphic
- Saving the edited graphic as a *.jpg file
- Graphical display of:
  - Test level and analog monitoring port (if present)
  - Forward power and power meter measured value (if present)
  - Current of the monitoring probe (if present)

Path and file name of the displayed result or calibration file

Monitoring events at the current cursor frequency

Test parameters for the current cursor frequency and input voltage of the analog EUT monitoring port

Comment line: "MEMO COMMENT (SET)". Press the "SET" button to insert a predefined comment (see chapter 5.6.3), press the "STO" button to save a comment at the current cursor frequency

Comment line: "TITLE" (see chapter 5.6.3)

Example for a monitoring event

Comment line 1, contents as selected by the buttons "COMMENT LINE 1"

Comment line 2, contents as selected by the buttons "COMMENT LINE 2"

Stores the current graph as a *.jpg file

Prints the current graph

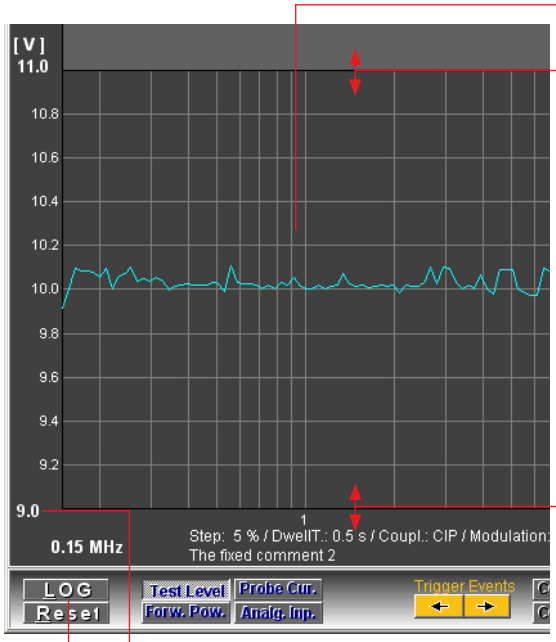
"+1": automated file naming,
"?": selectable file naming

Buttons for selection of the comment line 1/2 content. Press the "STO COM." button to save the three comment lines into the files comment area.

The "TRIGGER EVENTS" buttons allow the user to jump with the cursor to the next monitoring event.

Graph selection buttons

5.7.1.1. Graphical display



Frequency zoom: Click right mouse button and drag across the graph.

Level zoom method 1: Using the top field for upper limit or bottom field for lower limit, click with the left mouse button and drag up/down.

Level zoom method 2: Edit the numeric border values on the left side of the graph (X axis)

"LOG": Toggle between linear and logarithmic frequency display

"RESET": Reset frequency/level to their original values

5.7.1.2. Data evaluation / comment

Move the measurement cursor by clicking the left mouse button and dragging to the desired frequency position. The corresponding test data are displayed in the numeric fields above the graph and in the monitoring panel. Use the "TRIGGER EVENTS" buttons to move the cursor to the next monitoring event. Alternatively, the measurement cursor can be moved to the next monitoring event using the PC keyboard up and down arrows.

After placing the cursor on a specified test frequency, it is possible to input a single-line comment in the top right field. This is the "MEMO COMMENT (SET)" field, and can be defined as shown in chapter 5.6.4. Frequency comments. The "SET" button inserts a predefined comment. The user can edit this text as well. The "STO" button saves the first two lines of this field as a comment at the corresponding frequency position.

5.7.1.3. Comment lines

Note:
All changes made to the graphical comments here are only temporary, however they can be saved in the comments of the file using the "STO COM." button.

The three comment lines, "TITLE", "COMMENT LINE 1" and "COMMENT LINE 2", can be edited directly in the graph. The two buttons under the graph can be used to automatically fill "COMMENT LINE 1" or "COMMENT LINE 2" with the strings that are defined under Title/Comment in chapter 5.6.3..
Examples are shown in the tables below:

Comment line	Parameter as selected in "SETUP" -> "TITLE/COMMENT"	Example for the contents
"TITLE"	✓ Default Description ✓ Standard Nr. ✓ Measuring Device ✓ Serial Nr. ✓ Firmware Version	4-6 CDN / EM-CLAMP / CIP / IEC 61000-4-6 (2006) / NSG 4070-75 Nr: 000013 / V1.19

Table 2: Example of the contents of the comment line "TITLE" (incomplete)

Comment line	Parameter as selected in "SETUP" -> "TITLE/COMMENT"	Parameter as selected in "SHOW" window	Example for the contents
"COMMENT LINE 1"	("any" parameter)	File Com.	CIP / 10.0...10.0 V / 0.15...230.0 MHz / 5.0 % rem_temp.cal
"COMMENT LINE 1"	("any" parameter)	Fixed Com..	The fixed comment 1
"COMMENT LINE 1"	✓ Standard Comment	Comment 1	Step: 5 % / DwellT.: 0.5 s / Coupl.: CIP / Modulation: AM 1000 Hz 80 %
"COMMENT LINE 1"	✓ Fixed Comment 1	Comment 1	The fixed comment 1
"COMMENT LINE 1"	("any" parameter)	OFF	
"COMMENT LINE 1"	("any" parameter)	Stand. Com.	Step: 5 % / DwellT.: 0.5 s / Coupl.: CIP / Modulation: AM 1000 Hz 80 %
"COMMENT LINE 1"	("any" parameter)	Comment	

Table 3: Example of the contents of the comment line "COMMENT LINE 1" (incomplete)

Comment line	Parameter as selected in "SETUP" -> "TITLE/COMMENT"	Parameter as selected in "SHOW" window	Example for the contents
"COMMENT LINE 2"	("any" parameter)	File Com.	CIP / 10.0...10.0 V / 0.15...230.0 MHz / 5.0 % rem_temp.cal
"COMMENT LINE 2"	("any" parameter)	Fixed Com..	The fixed comment 2
"COMMENT LINE 2"	("any" parameter)	Cursor Com.	FR: 1.283500 MHz Trg: x TLev.: 10.00 V anlg. Volt.: 0.00 V
"COMMENT LINE 2"	✓ Standard Comment	Comment 2	Step: 5 % / DwellT.: 0.5 s / Coupl.: CIP / Modulation: AM 1000 Hz 80 %
"COMMENT LINE 2"	✓ Fixed Comment 2	Comment 2	The fixed comment 2
"COMMENT LINE 2"	("any" parameter)	OFF	
"COMMENT LINE 2"	("any" parameter)	Stand. Com.	Step: 5 % / DwellT.: 0.5 s / Coupl.: CIP / Modulation: AM 1000 Hz 80 %
"COMMENT LINE 2"	("any" parameter)	Comment	

Table 4: Example of the contents of the comment line "COMMENT LINE 2" (incomplete)

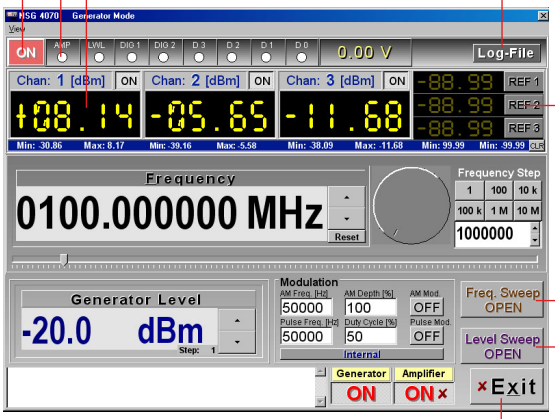
5.7.1.4. Saving the graph

The displayed graph can be saved as a *.jpg file using the "STORE" button whereby the adjacent yellow button, and determines the storage behavior. If this button shows "+1", the name is assigned automatically as: directory + name of the result file + _xxx + .jpg
where xxx is a sequential number. If the button shows "?", a file dialogue is invoked for selecting the path and entering a file name.

5.8. Generator window

The individual hardware components of the NSG 4070 can be controlled using the "GENERATOR" window and are available as quasi separate, independent devices. These are:

- Signal generator 9 kHz..1 GHz / -60..+10 dBm
- Power meter channel 1: -15…+27 dBm
- Power meters channel 2 and 3: -25…+20 dBm
- Power amplifier (not for NSG 4070-0) approx. 50 dB gain (depending on type)
- EUT monitoring inputs



Switches the status bar of the monitoring ports ON/ OFF.

EUT monitoring inputs and internal amplifier state

Power meter display

ON/OFF activates/deactivates the power meter display

Double clicking "dBm" changes the unit

Display of Min and Max hold values

Double clicking "MIN" or "MAX" resets the hold result. The "CLR" button (right-hand edge of the screen) resets all values

The measured values of the power meters and the states of the monitoring ports can be written to a LOG- file. See the next page for details.

Relative measurement function, sets the current measurement value to zero and shows the following differences

"FREQUENCY SWEEP"

a) Asynchronous sweep ("SINGLE FREE" / "CONTIN. FREE")

b) Synchronous sweep

"LEVEL SWEEP"

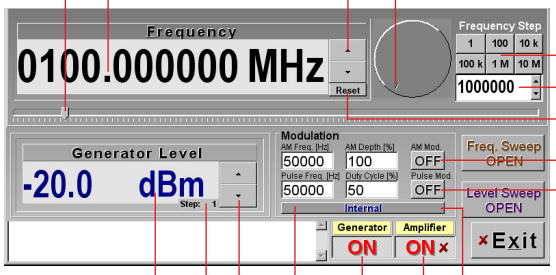
The level sweep is an asynchronous sweep which is started by the software but exclusively controlled by the NSG 4070. A simultaneous level and frequency sweep is not possible.

"EXIT" button to leave the "GENERATOR" window.

The RF level of the generator and internal amplifier will be set to off.

Attention:
Check the generator level before switching on the amplifier to avoid damaging power meters.

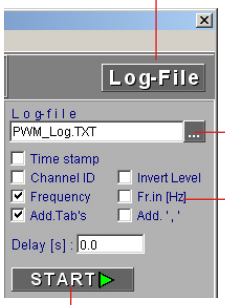
Attention:
The power meter inputs are very sensitive. Please avoid any direct connection of amplifier output and power meter input with high generator level (under these circumstances a maximum generator level of -30 dBm is recommended)



- **Frequency tuning (frequency value can also be typed in)**
- **Step size for knob and up/down keys**
- **Resets all digits after decimal point**
- **"AM MOD."**
  Switches the AM modulation ON/OFF. The modulation frequency and depth can be set.
- **"PULSE MOD."**
  Switched the pulse modulation ON/OFF. The modulation frequency and duty cycle can be set.
- **Modulation internal/external**
- **Amplifier (internal) ON/OFF**
- **Generator (RF level) ON/OFF**
- **Generator level display and tuning**
  Double clicking "dBm" changes the unit
  Double clicking "STEP 1" changes the step size

5.8.1. Generator window: LOG-file

The measured values of the power meters and the states of the monitoring ports can be written to a LOG- file, where a timestamp, the power meter channel number and the current frequency can optionally be inserted. However, it is not possible to simultaneously execute a frequency scan.



Opens/Closes the "LOG- FILE" menu for saving the power meter values in ASCII-file format.

"BROWSE" button for LOG-file selection.

Parameters

"ADD.TABS" inserts additional tabs for better readability. The measurement values of multiple power meter channels are displayed in one row.

"ADD.',"' inserts a comma between the parameters in a row. The measurement values of multiple power meter channels are displayed in one row.

"Fr. in [Hz]" inserts the current frequency in Hz. If unchecked, the current frequency is shown in MHz.

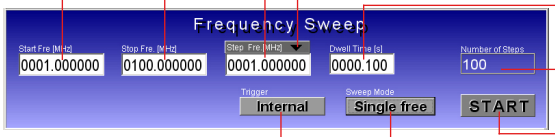
"INVERT LEVEL" inverts the measurement values (positive values to negative and neg. to pos.).

"DELAY [S]" inserts a defined wait time between the recording of two consecutive sets of measured values.

"START/STOP" button for writing the LOG-file.

5.8.2. Generator window: Frequency asynchronous sweep

The asynchronous sweep ("SINGLE FREE" / "CONTIN. FREE") is started by the software but exclusively controlled by the NSG 4070. This mode is intended to use the NSG 4070 as a tracking generator in conjunction with the external trigger input. The advantage of this mode is a short settling time. The maximum trigger frequency is 100 Hz.



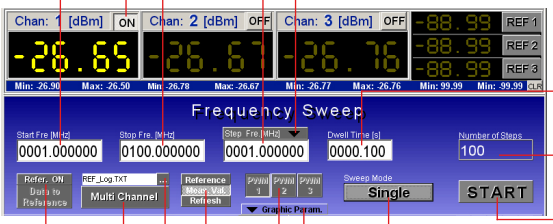
- **Start frequency in [MHz]**
- **Stop frequency in [MHz]**
- **Step frequency in [MHz]**
- **Step mode**
  - **-"LINEAR"**
  - **-"NO. PER DECADE"**
  - **-"PERCENTAGE"**
- **Dwell time [s]**
- **Number of steps**
- **Start sweep**
- **Sweep mode**
  - **-"SINGLE FREE" (sweep stops at stop frequency)**
  - **-"CONTINUOUS FREE" (press the stop button to terminate the sweep)**
  - **-"SINGLE" (see next chapter)**
  - **-"CONTINUOUS" (see next chapter)**
- **Trigger**
  - **-"INTERNAL"**
  - **-"EXTERNAL" (required the connection to the trigger input on the NSG 4070 back plane)**

5.8.3. Generator window: Frequency synchronous sweep

The "SYNCHRONOUS SWEEP" is fully controlled by the software. This enables a synchronous measurement using the NSG 4070's power meters, similar to a scalar network analyzer. Several additional functions are available in this mode, e.g. graphical display of the measurement results and reference measurements.

5.8.3.1. Synchronous sweep: Multi channel

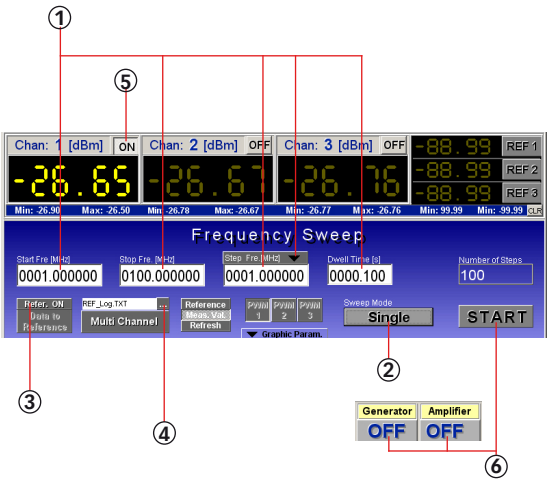
"MULTI CHANNEL" enables the synchronous measurement using up to 3 power meter channels (including the selected parameters in the log file window) and the recording of the measurement data in a log -file (ASCII format).



- **Start frequency in [MHz]**
- **Selected power meter (up to 3 can be selected)**
- **Stop frequency in [MHz]**
- **Step frequency in [MHz]**
- **Step mode**
  - **-"LINEAR"**
  - **-"NO. PER DECADE"**
  - **-"PERCENTAGE"**
- **Dwell time [s]**
- **Number of steps**
- **Start sweep**
- **Sweep mode**
  - **-"SINGLE"/ "CONTINUOUS" (press the "STOP" button to terminate the sweep)**
  - **-"SINGLE FREE"/ "CONTINUOUS FREE" (see previous chapter)**
- **Graphical parameter setup (see next page)**
- **Not used for "MULTI CHANNEL" mode**
- **"BROWSE" button for LOG- file selection**
- **Mode: "MULTI CHANNEL"/ "SINGLE CHANNEL"**
- **"REFER. ON" (requires reference results file)**
  "DATA TO REFERENCE" (requires "SINGLE" mode result which is used as reference for relative measurements)

Attention: **Reference values recorded in the "SINGLE CHANNEL" mode can be included in the current measurement using "REFER. ON". The measurement results will not be displayed.**

Step by step description:

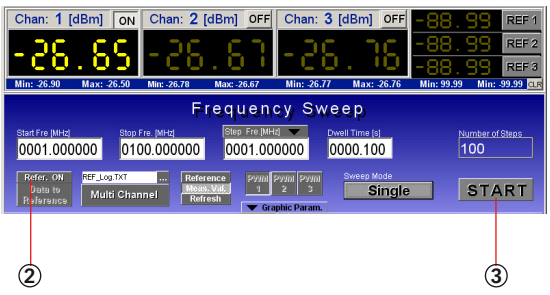


It is recommended that the NSG 4070 be allowed a warm up time of at least 10 minutes before performing measurements.

1. Define the sweep parameters
2. Select "SINGLE" or "CONTINUOUS" in the frequency sweep panel
3. Set "REFER. OFF"
4. Define the target file name in the frequency sweep window and the desired additional parameters in the "LOG- FILE" menu (see 5.8.1)
5. Activate the desired power meter channels
6. Set up the hardware (Connect RF out or Amp out to the selected power meter input. Activate "GENERATOR ON" and "AMPLIFIER ON" (if required) in the program). Start the measurement data recording using the "START" button.

WARNING: The power meter inputs are very sensitive. Please avoid any direct connection of amplifier output and power meter input with high generator level (under these circumstances a maximum generator level of -30 dBm is recommended).

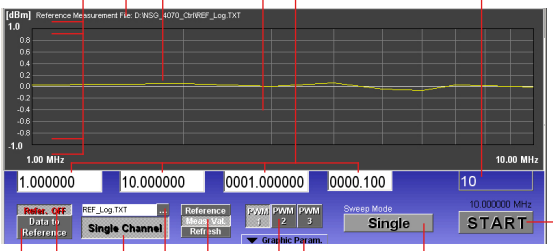
Step by step description for relative measurements:



1. Follow steps 1 - 6 as shown above
2. Set "REFER. ON" (Data must be measured in "SINGLE" channel mode before. See step by step advice in chapter 5.8.3.2)
3. Set up the hardware (e.g. insert the attenuator in the measuring circuit), start the measurement data recording using the "START" button

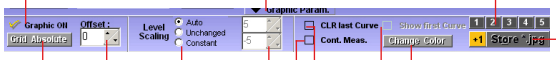
5.8.3.2. Synchronous sweep: Single channel

"SINGLE CHANNEL" mode enables numerical two port measurements and the graphical display ("GRAPHIC PARAM.") of the measurement results using one of the three power meter channels. Measurement results are recorded in a "REF-LOG" file. Prior to the two port measurement a reference or through calibration can be recorded ("REFER. OFF") and then be stored in the reference memory with the "DATA TO REFERENCE" key. "REFER. ON" includes the reference in the measurement.



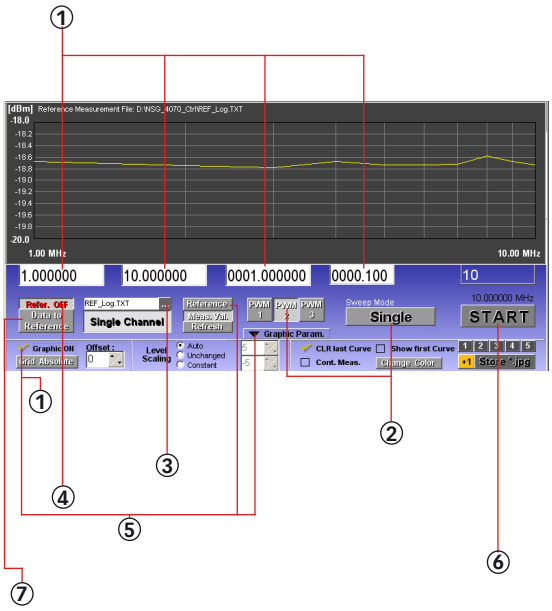
- **Clicking with the left mouse key (right hand user) (increased or decreased the level scaling) and drawing on the axis allows the user to change the scaling (level zoom)**
- **Path and name of: Reference measurement file**
- **Clicking with the left mouse key provides a cursor, result is displayed in the foot line of the diagram.**
- **Clicking the right mouse key allows the user to zoom details of the diagram (frequency zoom)**
- **Sweep parameter as described before**
- **Number of steps**
- **Start sweep**
- **Sweep mode: "SINGLE" / "CONTINUOUS"**
- **"GRAPHICAL PARAM." setup (see next page)**
- **Selected power meter**
- **Graphical display**
  - **-"REFERENCE": Shows the reference data**
  - **-"MEAS. VAL.": Shows the measurement values**
  - **-"REFRESH": Shows the last measured curve in the full frequency range**
- **"BROWSE" button for LOG-file selection**
- **Mode: "SINGLE CHANNEL" / "MULTI CHANNEL"**
- **"REFER. ON" / "REFER. OFF"**
  Normalized reference data are included in the current measurement results, graph shows relative values
- **"DATA TO REFERENCE"**
  Sets the last measurement result to reference. Each power meter has own reference

Graphical parameter setup



- Graphical display ON/OFF
- Graphical parameter setup ON/OFF
- Click to load parameters/ hold for at least 1 s to save current sweep parameters
- Saves the graph as *.jpg.
  -"+1": Names file automatically
  -"?": Browse button for jpg-file selection
- "CHANGE COLOR" button (valid for next curve and useful for "CONTINUOUS" mode)
- In "CONTINUOUS" mode the first curve remains temporarily on the screen
- Clears the last curve at measurement start
- Uncheck this to terminate a continous measurement at stop frequency
- Level scaling at "REFR." / "MEAS. VAL." / "REFRESH"
  -"AUTO" (auto scaling)
  -"UNCHANGED"
  -"CONSTANT" (allows the user to set parameters for the level axis)
- Offset parameter for measuring data
- Changes the grid to relative/absolute
  The "GRID RELATIVE" mode shows the measurement results independently from the generator level at 0 dBm. It is also required to perform the reference data measurement with "GRID RELATIVE".

Step by step description:

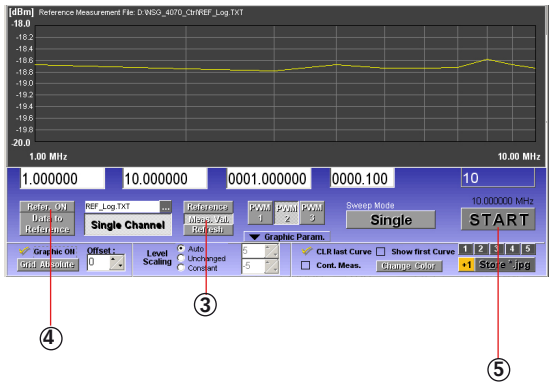


It is recommended that the NSG 4070 be allowed a warm up time of at least 10 minutes before performing measurements.

1. Define the sweep parameters (Switch off the graphical display for better orientation).
2. Select "SINGLE" or "CONTINUOUS" in the "FREQUENCY SWEEP" panel and choose one of the power meter channels using the "PWM 1" to "PWM 3" keys.
3. Choose the target file name for recording of the measurement data.
4. Set "REFER. OFF" for reference measurement / through calibration (Note: a free choice of frequency range is possible only in this mode, otherwise the frequency range will be limited to the reference / through calibration data.)
5. Activate the graphical display ("GRAPHIC PARAM."/ "GRAPHIC ON") and use the key to display the last reference values ("REFERENCE")
6. Set up the hardware. (Connect RF out or Amp out to the selected power meter input. Activate "GENERATOR ON" and "AMPLIFIER ON" if required in the program). Note: an attenuator may be needed to protect the power meter input when using the power amplifier!). "START" starts the through calibration
7. "DATA TO REFERENCE" stores the current measurement data in the reference memory.

WARNING: The power meter inputs are very sensitive. Please avoid any direct connection of amplifier output and power meter input with high generator level (under these circumstances a maximum generator level of -30 dBm is recommended).

Step by step description for relative measurements:



1. Follow steps 1 - 7 as shown above
2. Set up the hardware (e.g. insert the attenuator in the measuring circuit).
3. Change the graph from the reference to the measurement values using "MEAS. VAL.".
4. Set "REFER. ON" to include the reference in the measurement. The reference values will be subtracted from the current measurement values. Note that in this mode the frequency range will be limited to the reference / through calibration data.
5. Press "START" to start the measurement.

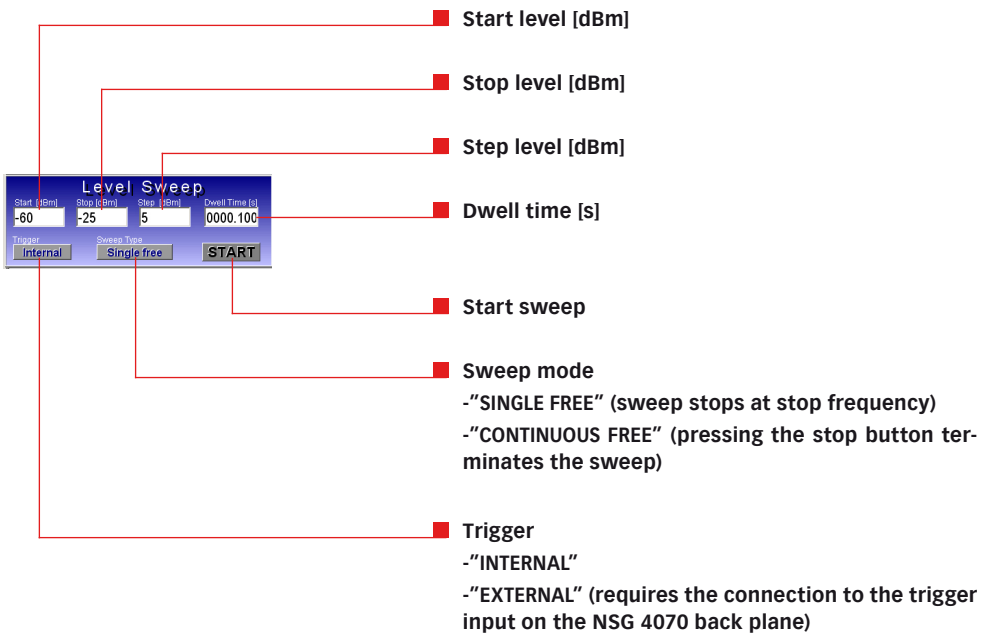
Note:
Measurement results can be stored in different files using the file dialog. These files can be recalled later to be set as a new reference using "DATA TO REFERENCE".

Each power meter channel can have an individual reference. Using "DATA TO REFERENCE" will store the measurement values as a reference for the current activated power meter channel.

The file dialog defines only the file name and the directory of the measurement data file. The file itself will be created in conjunction with the start of the measurement. Therefore the graphical display of a new file using "REFRESH" is not possible.

5.8.4. Generator window: Level sweep

The "LEVEL SWEEP" is an asynchronous sweep which is started by the software but exclusively controlled by the NSG 4070. A simultaneous level and frequency sweep is not possible.



5.9. Immunity window

5.9.1. File system

Calibration and test results are stored in files with the following extensions:

*.res : result file of an immunity test
*.cal : system calibration file (compatible to NSG 4070 file)
*.mon : monitoring probe calibration file (compatible to NSG 4070 file)
*.blv : BCI level definition file
*.bcl : BCI system calibration file for frequency dependent test levels (BCI segment sweep)
*.brs: BCI result file for frequency dependent test levels (BCI segment sweep)

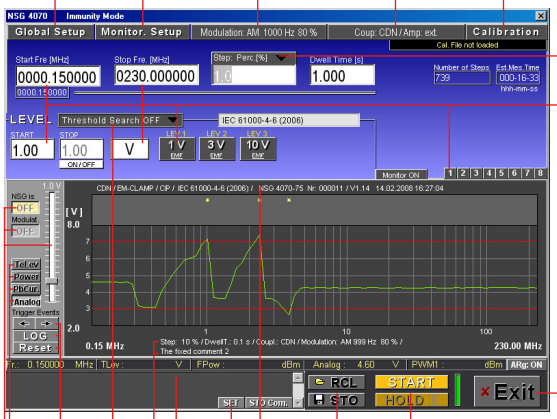
5.9.2. General function

It is always necessary to perform a system calibration or to load a stored system calibration before starting an immunity test. The corresponding file for loading the calibration data must be in the NSG 4070's memory. The test level unit of the system calibration (see "CALIBRATION" window in the upper right corner) must match the test level unit of the current test.

When the "IMMUNITY" window is opened the settings and the results of the last test are displayed automatically. The associated system and monitoring probe calibration data (as rem_temp.cal / rem_temp.mon) are copied to the NSG 4070 and activated in order to enable the immediate repetition of the last test with the same parameters (only possible for a network connection).

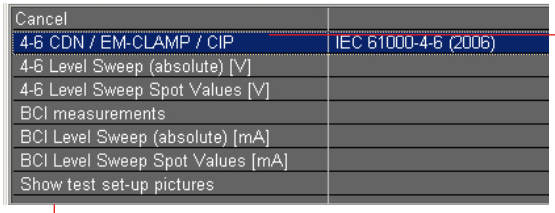
The same procedure is executed when loading a saved test with "RCL". If there is no network connection, the corresponding calibration files must be activated manually (see chapter 5.9.3.7).
When the results of an immunity test are stored, the associated system and monitoring probe calibration data are also saved in a *.res file.
In addition to constant test levels a slope from start to stop level can be defined.

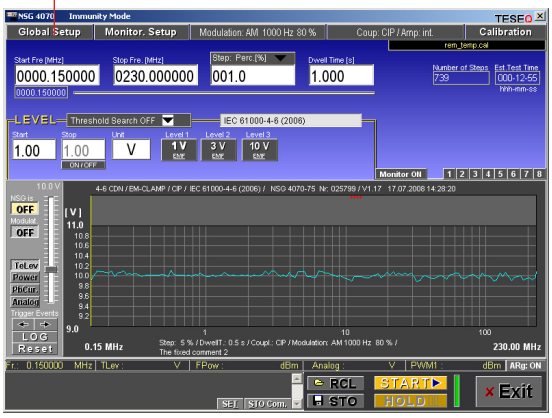
5.9.3. Window elements



- The top part of the screen is used for the “GLOBAL SETUP”, “EUT MONITORING SETUP” and for test parameter definition.
- Test setup and probe calibration parameters can be defined in the “CALIBRATION” window
- The “STEP WIDTH” menu includes the option of defining a maximum frequency step size (ISO-steps, see also chapter 4.5.1.4.1).
- The test parameters “FREQUENCY” and “LEVEL” can be set directly. Using the keys 1..8 a complete test parameter set can be stored (long keystroke, approx. 1 s) or recalled (short keystroke).
- The “EXIT” button to leave the “IMMUNITY” window.
- The “START” and “HOLD” button to start/interrupt the immunity test.
- The “RCL” and “STO” button to recall/store the immunity test results.
- Comments regarding the specified frequency, EUT monitoring event or general test documentation may be inserted.
- Button for the “THRESHOLD SEARCH” menu.
- Buttons to investigate the result and for changing the scaling of the graph
- Buttons to show different result graphs
- Slider and buttons for manual change of the test level

5.9.3.1. Global setup





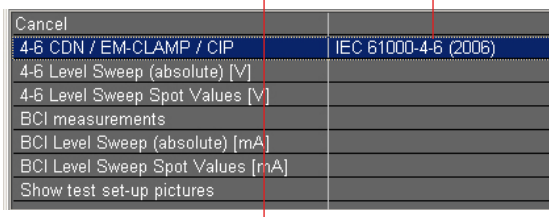
Different operating modes can be selected in the "GLOBAL SETUP" menu. Depending on the operating mode the input elements of the "IMMUNITY" window and some menus will be modified.

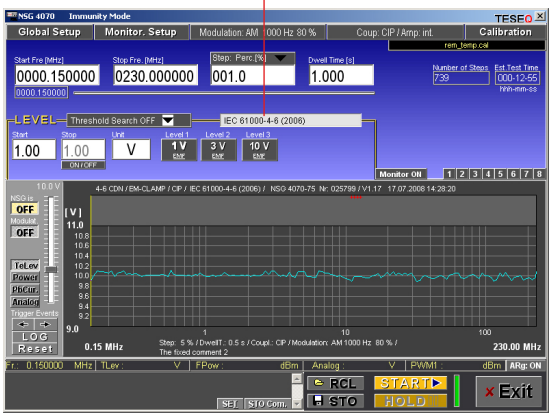
Pressing and holding a menu item will change these default values with the currently tuned parameters.

The menu items "4-6..." are intended for immunity tests according to IEC/EN 61000-4-6. The unit of the test level is V. Items starting with "BCI..." are associated to the BCI test. The unit of the test level for BCI tests is mA or dBµA.

"SHOW TEST SETUP PICTURES" opens a window that displays different test setup pictures from the instruction manual.

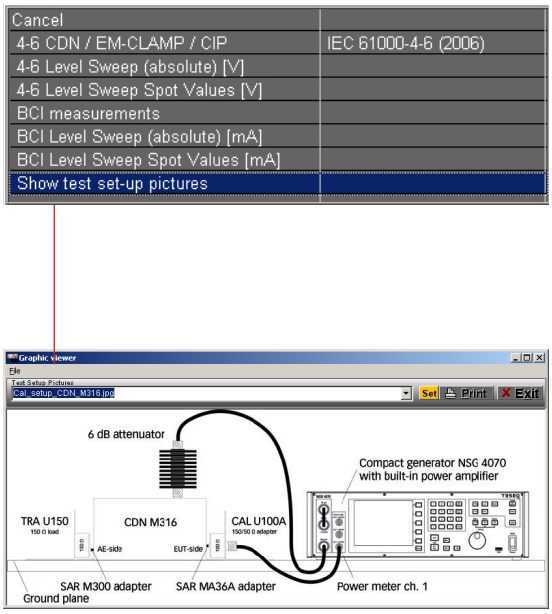
When a new operating mode is selected all measurement parameters will be set to default values. Furthermore the text of the first column of the "GLOBAL SETUP" menu will be assigned to the default description parameter which can be a component of the graphic title line (see chapter 5.6.3 Title/ Comment). The text for the second column will be copied to the "STANDARD" field of the "IMMUNITY" window and can be edited there.





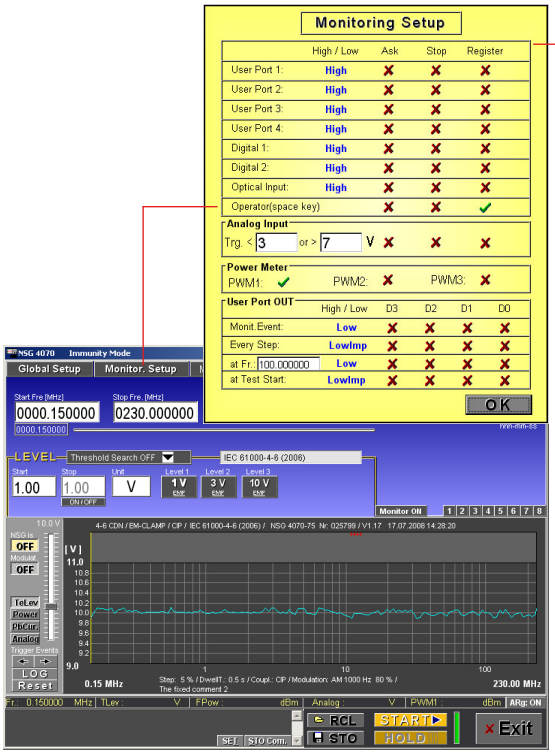
The text for the second column will be copied to the "STANDARD NR." field of the "IMMUNITY" window and can be edited there.

Pressing and holding a menu item will change this default values with the currently tuned parameters.



- **"SHOW TEST SETUP PICTURES" opens a window that displays different test setup pictures from the instruction manual of the coupling device.**

5.9.3.2. EUT Monitoring setup

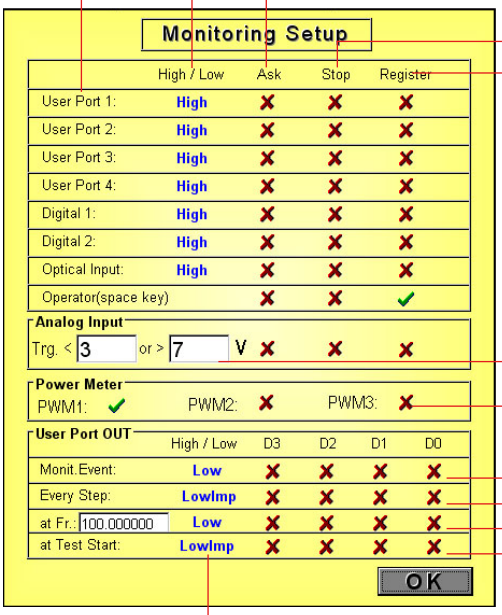


- **This window controls the behavior of the NSG 4070 when a monitoring event occurs.**

  In addition to the functions of the NSG 4070, it is also possible to activate one of the power meter channels and store its measured values together with the other test data. The graphical display of the measured values can be activated using the "POWER" button.

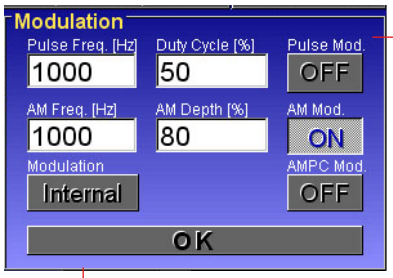
  Furthermore the activation of a manual trigger, initiated by the operator via the space key (PC keyboard), is possible. This trigger event is handled by the program like any other monitoring event.

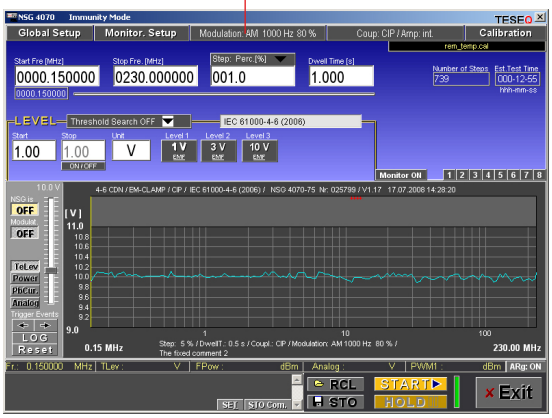
  The lower part of the window allows the activation of user port outputs at specific test frequencies or monitoring events. Switching the user port outputs at a certain test frequency causes the RF output and amplifier to be switched off for 150 ms in order to use this function for switching between two external amplifiers with low power relay switching.



- **EUT monitoring port input and PC space key**
- **Active state**
  "LOW": Sets the selected output from high level to low
  "HIGH": Sets the selected output from low level to high
- **Interrupts test/sweep and proceeds depending on user decision (Window appears during the test)**
  ✕ not in use
  ✓ selected
- **Stop test**
- **Register monitor event in measurement results**
- **Analog monitor input with trigger limits**
- **Activates a power meter channel as monitoring input (available with remote operated NSG only)**
- **Activates a monitoring output bit depending on measurement status (available with remote operated NSG only)**
  "MONIT. EVENT": Every EUT monitoring event provides a selected output.
  "EVERY STEP": Every step during the test provides a selected output.
  "AT FREQENCY XXX": Provides a selected output on a specified frequency.
  "AT TEST START": Provides a selected output on test start.
- **Active state**
  "LOW": Sets the selected output from high level to low
  "HIGH": Sets the selected output from low level to high
  "LOW IMPULSE": Sets the selected output from high level to low for a short impulse
  "HIGH IMPULSE": Sets the selected output from low level to high for a short impulse

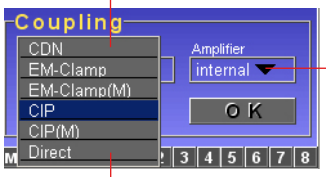
5.9.3.3. Modulation setup





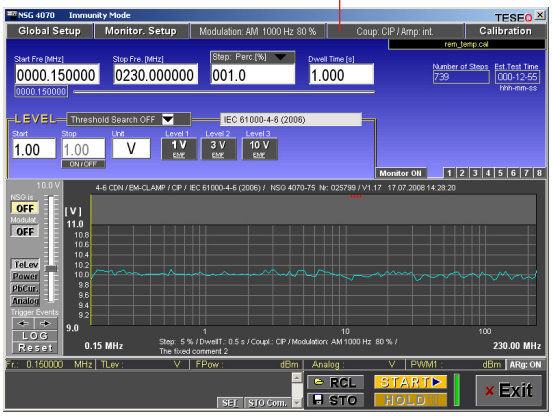
■ **Modulation can be set to pulse modulation, “AM”, “AM PC” or “OFF”. The “AM PC”: amplitude modulation with peak conversation is described in ISO 11452-1. The input on the NSG back panel is always active and can be used for external modulation sources.**

5.9.3.4. Coupling setup (only IEC 61000-4-6)

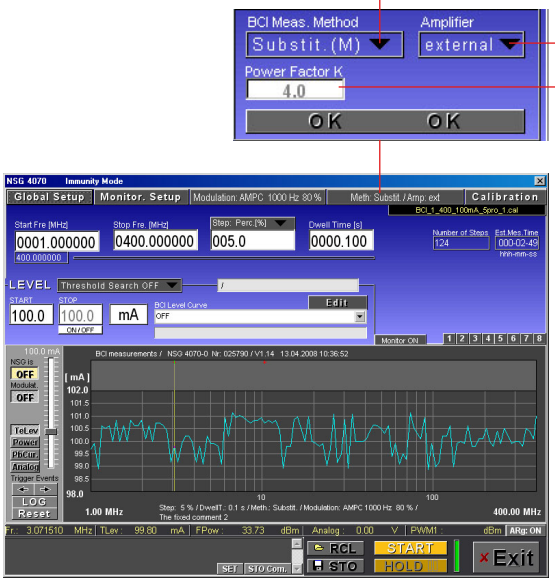


■ **The coupling device can be set to “CDN”, “EM-CLAMP”, “EM-CLAMP(M)” (EM-clamp with monitoring probe), “CIP” (current injection probe) and “CIP(M)” (CIP with monitoring probe). The selection “DIRECT” allows direct coupling to the EUT.**

■ **The menu allows the user to set the internal (not possible with NSG 4070-0) or external power amplifier.**

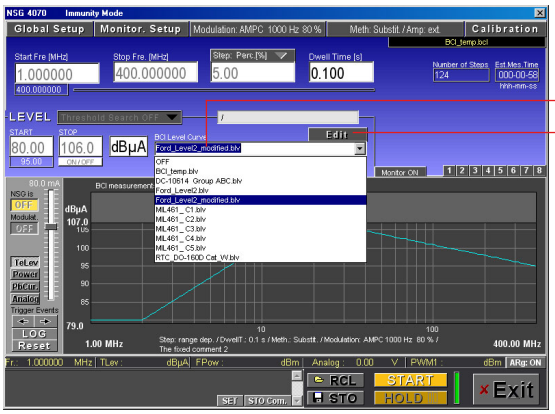


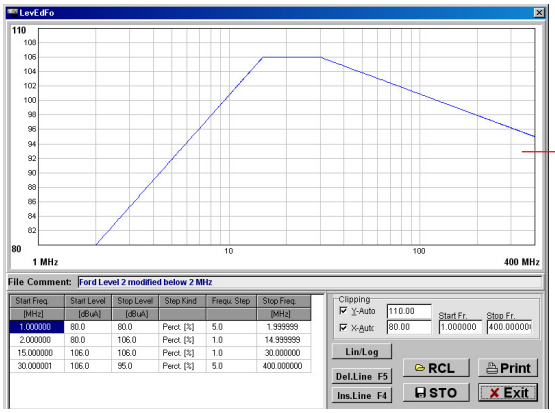
5.9.3.5. Testing method setup (only BCI)



- The testing method can be set to “SUBSTITUTION”, “SUBSTIT. (M)” (substitution with monitoring probe) and “CLOSED LOOP (M)” (always requires the use of the monitoring probe).
- The menu allows the user to set the internal (not possible with NSG 4070-0) or external power amplifier.
- Power limitation factor as described in ISO 11452-1 for the Closed loop method. Example: The forward power for the test is limited to 4 x higher forward power as calibrated. (See chapter 8.3.7 Power limitation factor for more information.)

5.9.3.6. BCI level editor (only BCI)



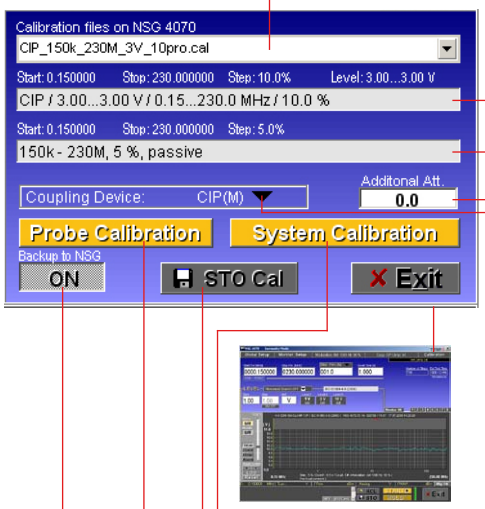


- A level definition file can be activated in the field “BCI LEVEL CURVE”. An activation of a level definition file also causes a change of the test mode, i.e. test parameters defined in the file cannot be changed. Choosing the item “OFF” from the list returns to the previous test mode.

  After a level definition file is selected, a system calibration can be performed. The calibration as well as the test are done in sections according to the frequency ranges of the level definition file. After the calibration the individual sections are put together and displayed as one curve. The calibration file should always be stored in the directory \BCI_LevDef_Cal or in the project directory with the extension *.bcl. Only files of this type and in these directories will be available for selection of a calibration file.

- The definition of an arbitrary test level curve can be done using the corresponding editor (“EDIT” key). User-defined frequency and test level ranges and step sizes can be defined in a table and stored in a file. The unit mA and dBµA can be selected by double click on the head of the table. The level definition file should be exclusively stored in the directory \BCI_LevDef_Cal with the extension *.blv. Only files of this type and in this directory will be visible in the list “BCI LEVEL CURVE”.

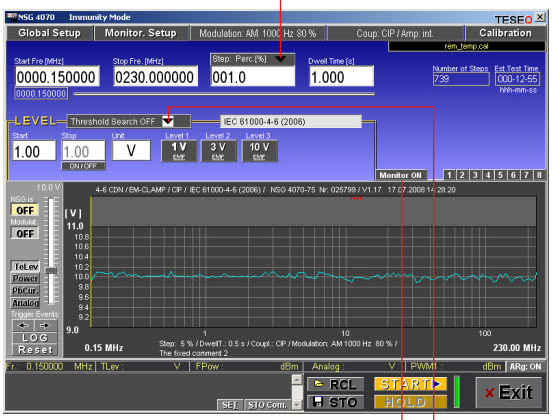
5.9.3.7. Calibration setup



- Clicking the "CALIBRATION FILES ON NSG 4070" field opens a pull down menu for selection of calibration files (*.cal, *.mon) saved on the NSG 4070 or BCI calibration files (*.bcl) from the PC. After selecting a file, this file is activated on the NSG 4070 and the basic parameters of this calibration are displayed simultaneously in the "CALIBRATION" window.
- The fields show the file comment of the loaded system calibration file and probe calibration file (required method with current probe in use e.g. "EM-CLAMP(M)")
- Parameter for additional attenuator to protect power meter 1 against levels above the limit.
- Coupling device selection (same as defined in the "COUPLING SETUP")
- The "SYSTEM CALIBRATION" button is used for performing a new calibration. The appropriate values for start and stop frequency, start and stop level and step size must be adjusted in the main window before starting the calibration.
- After the calibration is finished, the calibration results can be saved on the PC with the "STO CAL" button. If the "BACKUP TO NSG" button is pressed, this file is also copied to the NSG 4070 and is thus available for further measurements.
- The "PROBE CALIBRATION" button is used for performing a new calibration. Please note that the "PROBE CALIBRATION" button is only available if a "COUPLING DEVICE" with monitoring probe (e.g. "EM-CLAMP(M)") is selected. The appropriate values for start and stop frequency and step size must be adjusted in the main window before starting the probe calibration.
- The function "BACKUP TO NSG" allows the user to copy the calibration result file additionally to the NSG 4070. (required remote connection: "NETWORK")

Note:
The frequency, dwell time and level parameters are not affected by the loading of a calibration file. If the configured test level differs from the calibration level a temporary message will be displayed at the top edge of the screen. If the test frequency range exceeds the calibration frequency range the test will not run and an error message will be displayed in the message window at the bottom left of the screen.
Test levels deviating from the calibration level will be interpolated.

The "STEP WIDTH" menu includes the option of defining a maximum frequency step size (ISO-steps, see also chapter 4.5.1.4.1). An additional divisor can be defined to divide the max. step size, e.g. by 2 to duplicate the number of frequency steps.

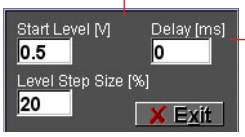


Using the field "THRESHOLD SEARCH", an automatic susceptibility threshold search can be activated prior to the test start. Three different methods as well as the setup window can be selected. (See also chapter 5.9.4.4. Testing with threshold search)

"THRESHOLD SEARCH UP"
In case of a monitoring event the test level will be reduced to a definable start level and then increased up to the occurrence of a new monitoring event using a definable step width. This susceptibility threshold will be documented in conjunction with the trigger events.

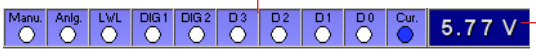
"THRESHOLD SEARCH DOWN"
In case of a monitoring event the test level will be reduced using a definable step width until the monitoring event ends. This susceptibility threshold will be documented in conjunction with the trigger events.

"THRESHOLD SEARCH MIL461E"
This threshold search according to the requirements of the MIL461 standard:
-reduces the test level using the current step size until the monitoring event ends and further reduces of the test level by 6 dB
-then the test level until is increased the monitoring event occurs again



Threshold search "SETUP". See also chapter 5.9.4.4. Testing with threshold search)

The parameter "LEVEL STEP SIZE [%]" is related to the maximum test level of the test.



Shows the EUT monitoring events.

5.9.4. Testing

5.9.4.1. General

The immunity test can be started with the "START" button after loading the calibration data. The test level is displayed in the graph. Additionally the digital / analog monitoring ports are displayed if activated with the button "MONITOR ON".
It is recommended that the NSG 4070 be allowed a warm up time of at least 10 minutes before performing calibration or testing.

Pre-conditions (CDN, EM-clamp, CIP, direct coupling for IEC 61000-4-6):

- "GLOBAL SETUP": select "4-6 CDN / EM_CLAMP / CIP"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation
- "COUPLING SETUP": select coupling device and amplifier
- "CALIBRATION SETUP": load system calibration from NSG
- Set test parameters: start/stop frequency, step size, dwell time, start/stop level
- Set "THRESHOLD SEARCH OFF"
- Set "MONITOR ON" (optional)

Pre-conditions (EM-clamp (M) and CIP (M) for IEC 61000-4-6):

- "GLOBAL SETUP": select 4-6 CDN / EM_CLAMP / CIP
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation
- "COUPLING SETUP": select coupling device and amplifier
- "CALIBRATION SETUP": load system calibration from NSG
- "CALIBRATION SETUP": load probe calibration from NSG
- Set test parameters: start/stop frequency, step size, dwell time, start/stop level
- Set "THRESHOLD SEARCH OFF"
- Set "MONITOR ON" (optional)

Attention:
Remove the connection to the power meter channel 1 after calibration. Test levels above 18 V may could damage the power meter because of the modulation.

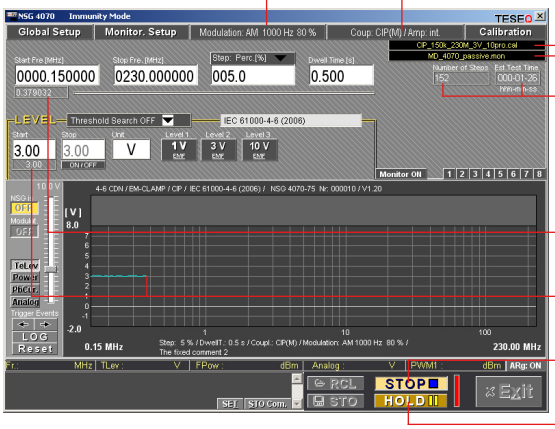
Pre-conditions (BCI measurements without "BCI LEVEL CURVE"):

- "GLOBAL SETUP": select "BCI MEASUREMENTS"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation (AMPC)
- "COUPLING SETUP": select BCI method, power limitation factor and amplifier
- "CALIBRATION SETUP": load system calibration from NSG
- "CALIBRATION SETUP": load probe calibration from NSG (only for substitution (M) and Closed loop method)
- Set test parameters: start/stop frequency, step size, dwell time or start/stop level
- Set "THRESHOLD SEARCH OFF"
- Set "MONITOR ON" (optional)

Pre-conditions (BCI measurements with "BCI LEVEL CURVE"):

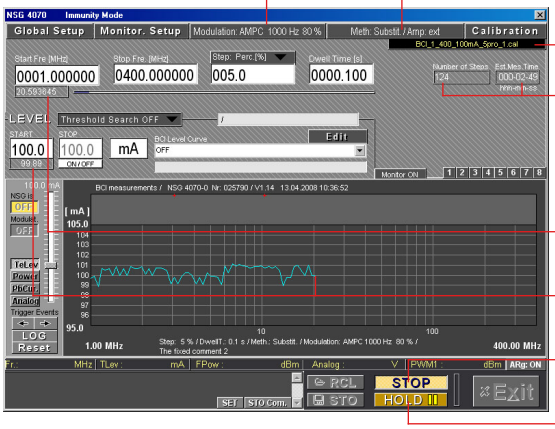
- "GLOBAL SETUP": select "BCI MEASUREMENTS"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation (AMPC)
- "COUPLING SETUP": select BCI method, power limitation factor and amplifier
- "CALIBRATION SETUP": load *.bcl calibration file from the PC (file includes "BCI LEVEL CURVE")
- "CALIBRATION SETUP": load probe calibration from NSG (only for substitution (M) and Closed loop method)
- Set "THRESHOLD SEARCH OFF"
- Set "MONITOR ON" (optional)

Example of IEC/EN 61000-4-6 testing with CIP and monitoring probe



- Modulation: AM 1000 Hz 80%
- Coupling device: CIP (M)
  Amplifier: internal
- System calibration file (NSG)
- Probe calibration file (NSG)
- Number of steps and estimated test time
- Current test frequency
- Current test level
- Start/ Stop test
- Hold / Continue test

Example of BCI testing with Substitution method

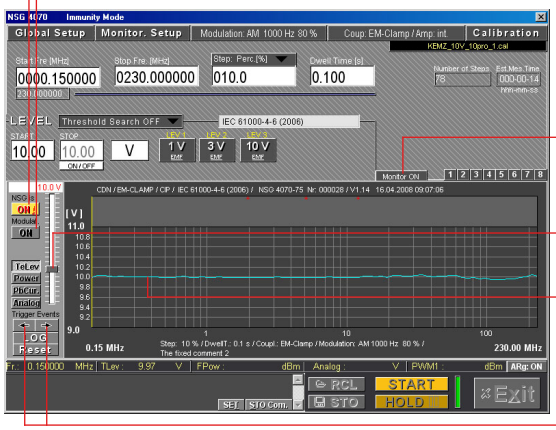


- Modulation: AM PC 1000 Hz 80%
- Method: Substitution
  Amplifier: external
- System calibration file (NSG)
- Number of steps and estimated test time
- Current test frequency
- Current test level
- Start/ Stop test
- Hold / Continue test

Warning: The function "HOLD" interrupts only the sweep. The test level is still present on the output.

5.9.4.2. Testing with manual change of frequency and level

If the test is finished, the test level at the current cursor frequency can be activated and deactivated with the "NSG IS" button for manual examination of the EUT. The slider to its right allows the user to change the test level, which is limited to three times the current test level. The current level is displayed directly above the slider. There is a continuous query and display of the monitoring ports when the NSG 4070 output is activated.



- **Button for switching the NSG ON/OFF**
- **Button for switching the modulation ON/OFF**
- **Button for switching the EUT monitoring panel ON/OFF**
- **Slider for manually changing the test level**
- **The test frequency can be changed by clicking the left mouse key in the graph or by using the PC arrow keys.**
- **The test frequency can be changed by using the "TRIGGER EVENTS" button.**

Attention:
The highest accuracy is achieved by testing on calibrated frequencies and with calibrated test levels.

5.9.4.3. Testing with the level sweep modes

The "LEVEL SWEEP" modes allow the examination of the EUT by changing the test level. These modes can be activated in the "GLOBAL SETUP" menu (see chapter 5.9.3.1). The absolute values sweep offers to define start, stop and step frequency. A table can be filled out if using the "LEVEL SWEEP SPOT VALUES" mode.

Pre-conditions (CDN, EM-clamp, CIP, direct coupling for IEC 61000-4-6):

- "GLOBAL SETUP": select "4-6 LEVEL SWEEP (ABSOLUTE) [V]" or "4-6 LEVEL SWEEP SPOT VALUES [V]"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation
- "COUPLING SETUP": select coupling device and amplifier
- "CALIBRATION SETUP": load system calibration from NSG
- Set test parameters: start/stop frequency, step size, dwell time, start/stop level
- Set "MONITOR ON (OPTIONAL)"

Pre-conditions (EM-clamp (M) and CIP (M) for IEC 61000-4-6):

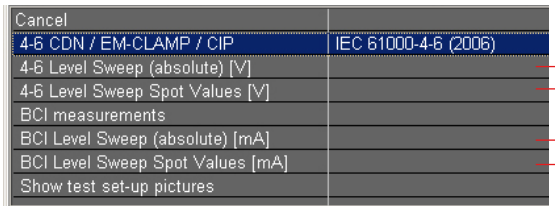
- "GLOBAL SETUP": select "4-6 LEVEL SWEEP (ABSOLUTE) [V]" or "4-6 LEVEL SWEEP SPOT VALUES [V]"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation
- "COUPLING SETUP": select coupling device and amplifier
- "CALIBRATION SETUP": load system calibration from NSG
- "CALIBRATION SETUP": load probe calibration from NSG

- Set test parameters: start/stop frequency, step size, dwell time, start/stop level
- Set "MONITOR ON" (optional)

Attention:
Remove the connection to the power meter channel 1 after calibration. Test levels above 18 V may could damage the power meter because of the modulation.

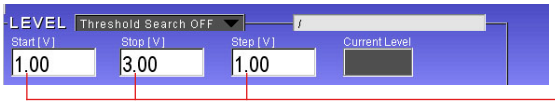
Pre-conditions (BCI measurements):

- "GLOBAL SETUP": select "BCI LEVEL SWEEP (ABSOLUTE) [MA]" or "BCI LEVEL SWEEP SPOT VALUES [MA]"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation (AMPC)
- "COUPLING SETUP": select BCI method, power limitation factor and amplifier
- "CALIBRATION SETUP": load system calibration from NSG
- "CALIBRATION SETUP": load probe calibration from NSG (only for substitution (M) and Closed loop method)
- Set test parameters: start/stop frequency, step size, dwell time, start/stop level
- Set "MONITOR ON" (optional)



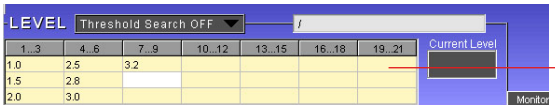
"GLOBAL SETUP" menu with "LEVEL SWEEP" modes for IEC/EN 61000-4-6 and BCI testing

Example of setting the "LEVEL SWEEP ABSOLUTE VALUES"



The test level can be set directly.
Example:
Start: 1 V, stop: 3 V and step: 1 V
The test will be performed at every test frequency with 1 V, 2 V and 3 V.

Example of setting the "LEVEL SWEEP SPOT VALUES"



The test level can be set directly.
The test will be performed at every test frequency as written in the table.

The "LEVEL SWEEP" can be started with the "START" button. The test level is displayed, and the digital / analog monitoring ports are also displayed if activated in the main window.

5.9.4.4. Testing with threshold search

Using the function "THRESHOLD SEARCH", an automatic susceptibility threshold search can be activated prior to the test start. Three different methods as well as the setup window can be selected. The chapter 5.9.3.8 describes the menus.

Pre-conditions (CDN, EM-clamp, CIP, direct coupling for IEC 61000-4-6):

- "GLOBAL SETUP": select "4-6 CDN / EM_CLAMP / CIP"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation
- "COUPLING SETUP": select coupling device and amplifier
- "CALIBRATION SETUP": load system calibration from NSG
- Set test parameters: start/stop frequency, step size, dwell time, start/stop level
- Set "THRESHOLD SEARCH ON"
- Set "MONITOR ON" (optional)

Pre-conditions (EM-clamp (M) and CIP (M) for IEC 61000-4-6):

- "GLOBAL SETUP": select 4-6 CDN / EM_CLAMP / CIP
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation
- "COUPLING SETUP": select coupling device and amplifier
- "CALIBRATION SETUP": load system calibration from NSG
- "CALIBRATION SETUP": load probe calibration from NSG
- Set test parameters: start/stop frequency, step size, dwell time, start/stop level
- Set "THRESHOLD SEARCH ON"
- Set "MONITOR ON" (optional)

Attention:
Disconnect the power meter channel 1 for performing tests in the calibration setup with amplitude modulation and above 18 V EMF stress level.

Pre-conditions (BCI measurements):

- "GLOBAL SETUP": select "BCI MEASUREMENTS"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation (AMPC)
- "COUPLING SETUP": select BCI method, power limitation factor and amplifier
- "CALIBRATION SETUP": load system calibration from NSG
- "CALIBRATION SETUP": load probe calibration from NSG (only for substitution (M) and Closed loop method)
- Set test parameters: start/stop frequency, step size, dwell time or start/stop level
- Set "THRESHOLD SEARCH ON"
- Set "MONITOR ON" (optional)

“THRESHOLD SEARCH UP”

In case of a monitoring event the test level will be reduced to a definable minimum level (“THRESHOLD SEARCH SETUP”) and then increased up to the occurrence of a new monitoring event using a definable step width (“THRESHOLD SEARCH SETUP”). This susceptibility threshold will be documented in conjunction with the trigger events.

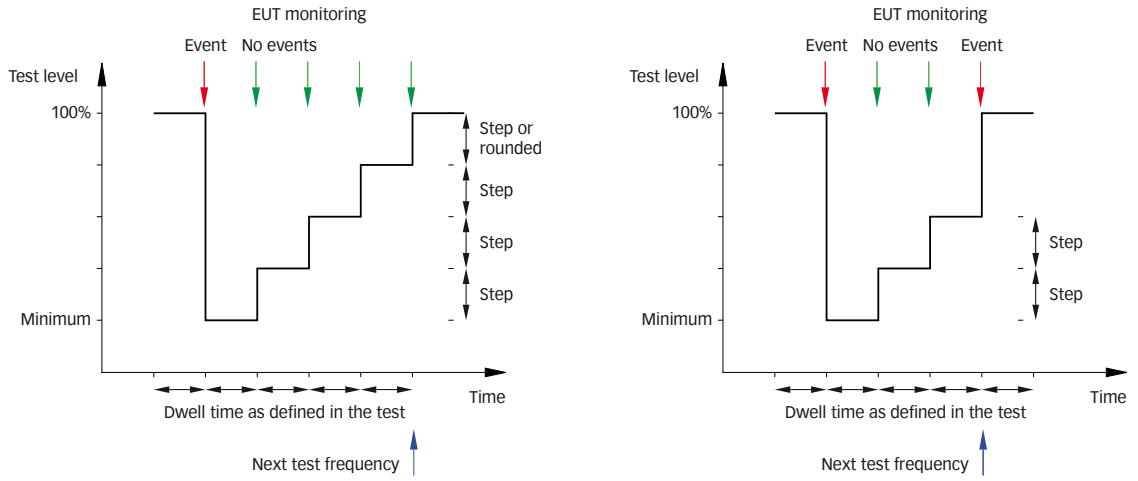


Figure 5: Example “THRESHOLD SEARCH UP”

Delay parameter

A delay parameter can be defined in the (“THRESHOLD SEARCH SETUP”) menu. The delay parameter may be used to allow a regeneration time for the EUT. This function is only available for “THRESHOLD SEARCH UP”.

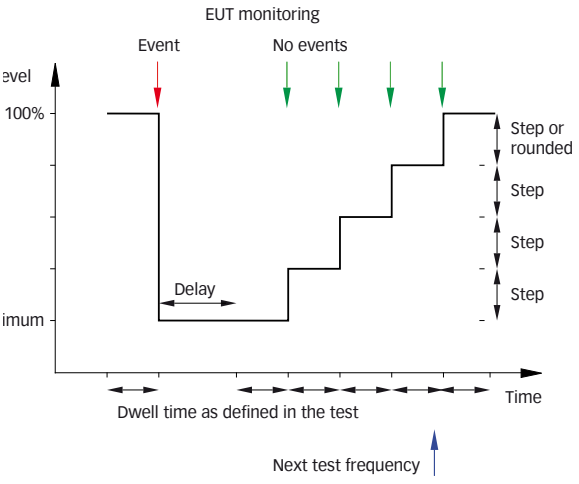


Figure 6: Example “THRESHOLD SEARCH UP” with delay

"THRESHOLD SEARCH DOWN"

In case of a monitoring event the test level will be reduced using a definable step ("THRESHOLD SEARCH SETUP") width until the monitoring event ends. This susceptibility threshold will be documented in conjunction with the trigger events.

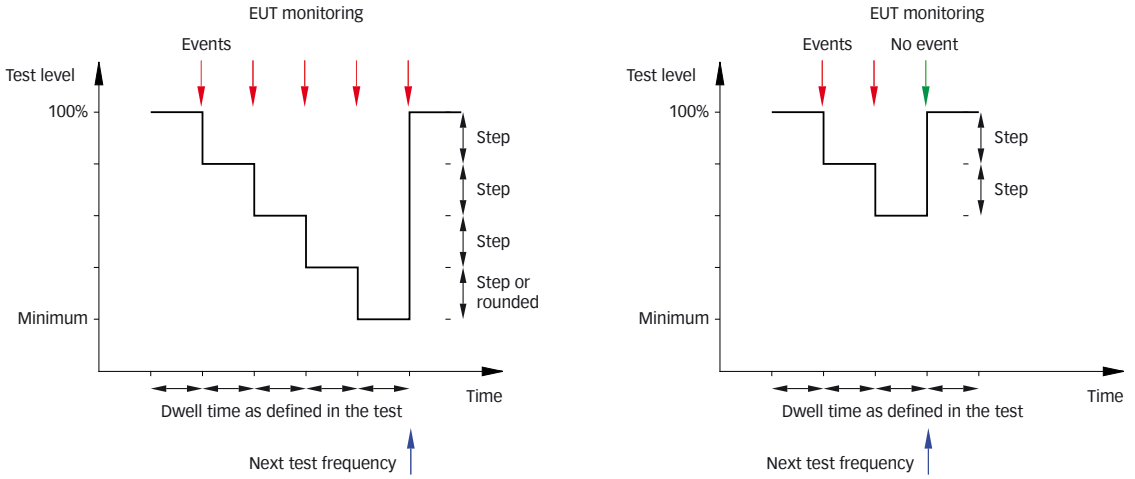


Figure 7: Example "THRESHOLD SEARCH DOWN"

"THRESHOLD SEARCH MIL 461"

The threshold search according to the requirements of MIL461 standard:

- Reduces the test level using the current step size until the monitoring event ends and further reduces the test level by 6 dB
- Increases the test level until the monitoring event occurs again

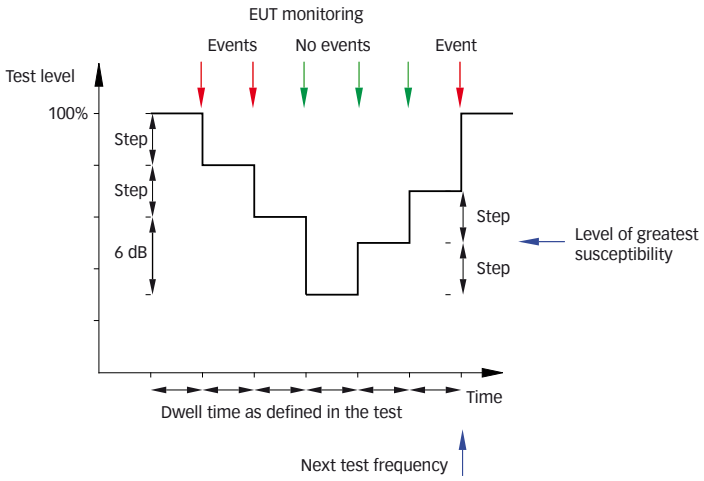


Figure 8: Example "THRESHOLD SEARCH MIL 461"

Start of the threshold search

The threshold search can be started with the "START" button. The test level is displayed, and the digital / analog monitoring ports are also displayed if activated in the main window.

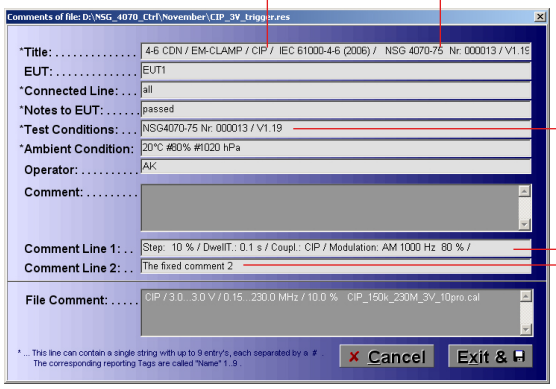
5.9.4.5. Save

After the measurement the test results can be saved in a result file (*.res) using the "STO" button. If "SHOW COMMENT PANEL AT STO" (see chapter 5.6.1 General settings) is selected an additional window for modification of the file comments is displayed before the file dialogue.
This window enables the modification of all the comments stored in a result file. The program automatically generates 5 comment entries for each immunity test. These are:

- First entry for "TITLE" graphic title line (contents as configured in the "SETUP" window)
- Second entry for "TITLE STANDARD" field (contents as configured in the "SETUP" window)
- First entry for "TEST CONDITIONS" NSG 4070 description with serial numbers and software version
- "COMMENT LINE 1" (contents as configured in the "SETUP" window)
- "COMMENT LINE 2" (contents as configured in the "SETUP" window)

At the same time, all other comments are cleared, however this can be deactivated in the "SETUP" window. See chapter 5.6.3 Title/Comment: "CLEAR ALL *.RES COMMENTS" for details.
The comments entered here can be used later for creating a test report. This means that all the information needed for the test report which cannot be automatically generated by the program must be entered here manually. Any line in the "COMMENT" window can be edited regardless of whether it is automatically generated or not.

Example 1 of the "COMMENT" window:

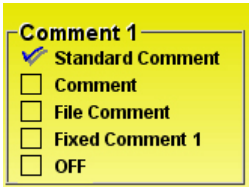


Title string (first entry) that can be configured in the "SETUP" menu (see example on the right side or chapter 5.6.3. Title/Comment for details)

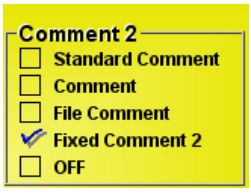
Title string (second entry) that came from the "TITLE STANDARD" field in the "IMMUNITY" window (see example on the right side or chapter 5.9.3.1.)

Test condition string (no configuration possible)

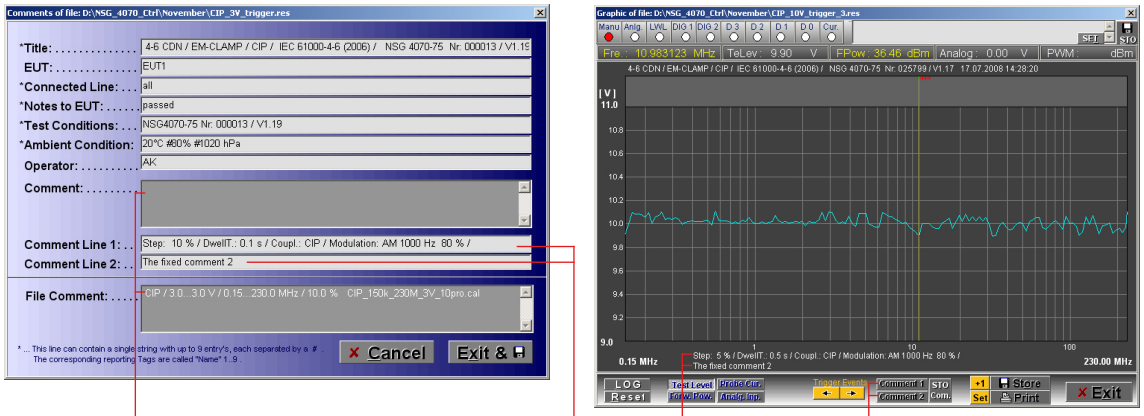
"COMMENT LINE 1" (that can be configured in the "SETUP" menu (see example on the right side or chapter 5.6.3. Title/Comment for details)



"COMMENT LINE 2" (that can be configured in the "SETUP" menu (see example on the right side or chapter 5.6.3. Title/Comment for details)

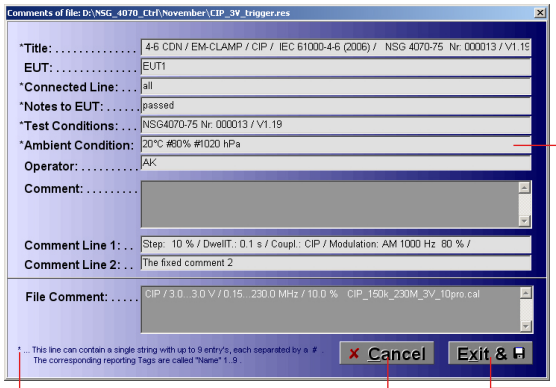


Example 2 of the “COMMENT” window:



- The “COMMENT LINE 1” and “COMMENT LINE 2” can be edited in the “COMMENT“ window (see left side) or can be edited and selected in the “SHOW” window (see right side).
- The “COMMENT” and “FILE COMMENT” can be edited in the “COMMENT” window (see left side) and can be selected in the “SHOW” window (see right side).

Example 3 of the “COMMENT” window:



- Three entries for temperature, humidity and pressure

  Example: 20°C#80%#1020 hPa
- Stores all strings in the result file
- Discards all changes that are done here
- All comment lines starting with * can contain up to 9 entries which are separated from each other with the # character. These entries can be referred to using an appropriate report template during the creation of the report.

5.9.4.6. Test report

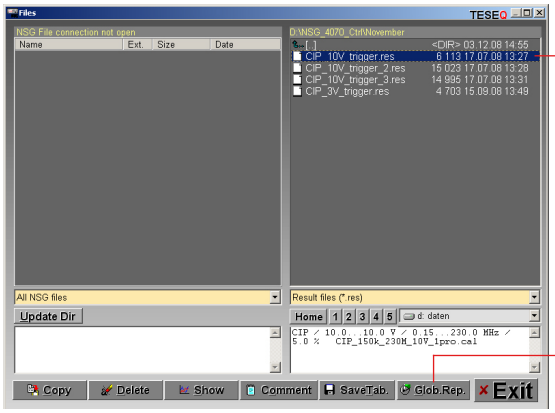
Reports can be generated automatically by pressing the "GLOBAL REPORT" button in the "FILES" window . The starting point for report generation is a report template file - a report template designed in any way by the user in *.rtf format which contains Reporting Tags. The Reporting Tags are placeholders for data from the result file which are replaced by the corresponding test data during the report creation.
A program for the easy selection and placement of these placeholders can be found in the /TemplateAssistant directory. The following procedure is recommended for generating your own report template file:

- - Write a report template with a word processing program (e.g. MS Word) and save this template as a *.rtf file.
- - Open the template file and Template Assistant simultaneously, select the corresponding Reporting Tag with the mouse in the Template Assistant and drag this to the required position in the template.

Attention:
The Reporting Tags should always be inserted with the Template Assistant. Manual copying and editing of the tags in the word processor usually results in error messages during report generation. If an error occurs, the corresponding Tag must be deleted completely and placed again with the Template Assistant.

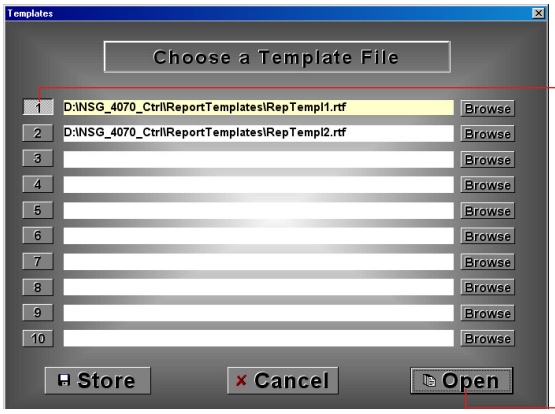
Word processing programs vary widely in their ability to display *.rtf files, and MS Word was used during NSG 4070 software development. Newer versions of MS Word will activate Smart Tags by default. Before creating a template file Smart Tags must first be deactivated under Tools / Autocorrect Options/ Smart Tags.

Step by step description for report generation:



Select a *.res-file in the "FILES" menu

Press the "GLOBAL REPORT" button



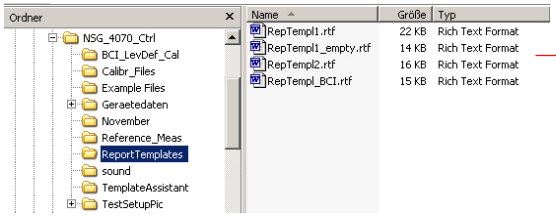
Select a template *.rtf-file

Ten different report template files can be selected. Report files can either be saved directly or displayed in a window, edited, printed and saved.

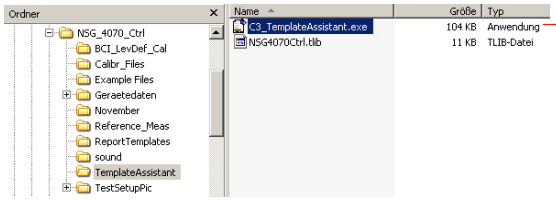
Attention:
The old report file must always be closed before creating a new test report.

Press "OPEN" to see the generated report

Step by step description for template generation:

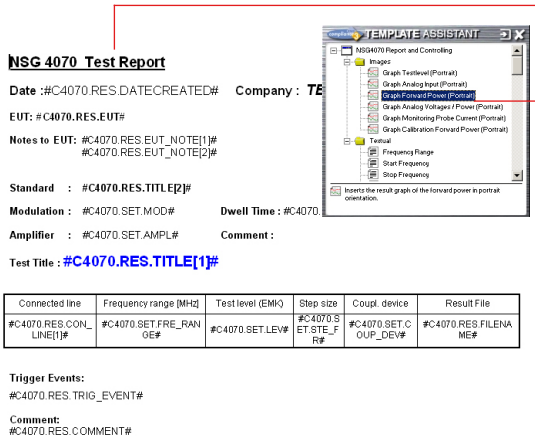


Open a template *.rtf-file with e.g. MS Word



Open the C3 Template Assistant

Go to the open template *.rtf-file

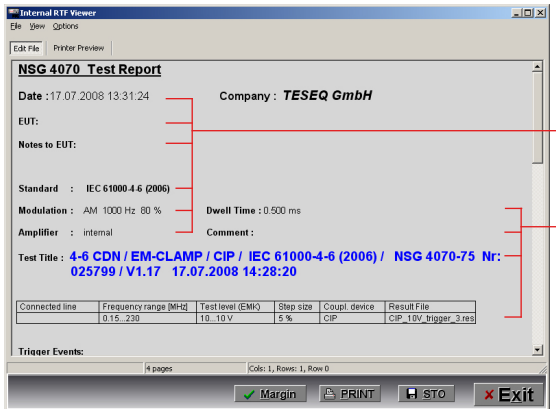


Select the corresponding Reporting Tag with the mouse in the Template Assistant and drag this to the required position in the template

Save the template *.rtf-file

5.9.4.7. RTF viewer

A simple RTF viewer has been integrated in the program; however, it cannot display multiline table lines and graphs. The user can call an external program to display and edit the *.rtf file. The settings for this must be selected under "SETUP". See chapter 5.6.1 for details.



Predefined reporting tags have been replaced by test data from the *.res file.

6. REMOTE CONTROL COMMANDS

6.1. Common commands

In the NSG 4070, the following common commands are implemented:

Command	Description
*IDN?	returns the identification string of the device
*RST	resets the NSG 4070 and loads default values
*GTL	switches the device back to local mode

Table 5: Common commands

6.1.1. *IDN?

This command delivers the device's identification string. This string is comprised of the device name and device type (Amplifier Power), the device's serial number and its software version.

***IDN?**

Teseq NSG 4070-75,000123,V1.0

6.1.2. *GTL

This command switches the device back to the local mode. Front panel operation is then permitted.

***GTL**

6.1.3. *RST

This command resets the receiver and loads the default values. All currently running sweeps are aborted. The synthesizer output and the amplifier are turned off.

***RST**

6.2. The SOURce subsystem

The SOURce subsystem contains all remote control commands that are necessary to modify the output signal of the NSG 4070 when it is used in generator mode.

6.2.1. Set fixed frequency (SOURce:FREQuency:FIXed|CW)

Set the fixed output frequency in generator mode. Values in Hz, kHz and MHz are accepted.

SOURce:FREQuency:FIXed 123.456 mhz

6.2.2. Set fixed level (SOURce:LEVel:AMPLitude)

Set the fixed output level in generator mode if RF is on (SOURce:POWER:LEVel:STATe is set). Values in dBm, dBuV and V are accepted.

SOURce:LEVel:AMPLitude -2.55 dbm

6.2.3. Output On/Off (SOURce:POWER:LEVel:STATe)

Turns output on/off when in generator mode.

POWER:LEVel:STATe on

6.2.4. Sweep parameters

The SOURce:SWEep mode contains all parameters that are required to set up a frequency or a level sweep. Included are the start and stop frequencies/levels, the dwell time for a specific step of a sweep, and the commands to start or abort a sweep.

- Dwell time (SOURce:SWEep:DWELl)
  This sets the dwell time for a frequency or level sweep. The NSG 4070 dwells this time on every step of the sweep. The time can be specified in seconds (s), millisec. (ms) or microsec. (us).
  SOURce:SWEep:DWELl 1.2 s

Bit	Description
0	if 1 then end of sweep is reached
1	if 1 an error occurred
2	if 1 the sweep was aborted by the user

Table 6: Sweep status byte

- Frequency sweep
  The frequency sweep node includes the commands which are necessary to configure and run a frequency sweep.

- Run frequency sweep (SOURce:SWEep:FREQuency:Run)
  This command starts a frequency sweep with the previously configured parameters.
  SOURce:SWEep:FREQuency:Run

- Run frequency sweep query (SOURce:SWEep:FREQuency:Run?)
  This command starts a frequency sweep with the previously configured parameters. Additionally, the current frequency and a status byte are returned for every frequency step. The description of the status byte can be found in table 5.6.2.
  SOURce:SWEep:FREQuency:Run?
  9000,0

- Abort frequency sweep (SOURce:SWEep:FREQuency:ABOrt)
  This command aborts the currently running frequency sweep.
  SOURce:SWEep:FREQuency:ABOrt

- Start frequency (SOURce:SWEep:FREQuency:STARt)
  This command sets the start frequency of a sweep. The start frequency can be determined in Hz, kHz or MHz.
  SOURce:SWEep:FREQuency:STARt 9000 hz
  SOURce:SWEep:FREQuency:STARt 15000 khz
  SOURce:SWEep:FREQuency:STARt 0.15 mhz

- Stop frequency (SOURce:SWEep:FREQuency:STOP)
  This command sets the stop frequency of a sweep. The stop frequency can be determined in Hz, kHz or MHz.
  SOURce:SWEep:FREQuency:STOP 230000000 hz
  SOURce:SWEep:FREQuency:STOP 80000 khz
  SOURce:SWEep:FREQuency:STOP 80 mhz

- Step width parameters
  The steps for a frequency sweep can be determined in either a linear mode with fixed step sizes, in numbers of steps per decade or as a percent increment.

- Linear step width (SOURce:SWEep:FREQuency:STEp:LINear)
  This command configures a linear frequency sweep with a fixed step size. The step size can be configured in Hz, kHz or MHz.
  SOURce:SWEep:FREQuency:STEp:LINear 10000 hz

- Decade step width (SOURce:SWEep:FREQuency:STEp:DECade)
  This command configures a decade sweep with x steps per frequency decade. The example below shows how to set up a sweep with 11 steps per decade.
  SOURce:SWEep:FREQuency:STEp:DECade 11

- Percental step width (SOURce:SWEep:FREQuency:STEp:PERCent)
  This command configures a percent sweep with a frequency increase of x % per step. The next frequency steps are calculated as follows:

$$f_{next} = f_{current} + x * \frac{f_{current}}{100}$$

  where x stands for the percental increase.
  SOURce:SWEep:FREQuency:STEp:PERCent 2.5

- Level sweep
  The level sweep node includes the commands which are necessary to configure and run a level sweep.

- Run level sweep (SOURce:SWEep:LEVel:Run)
  Use this command to trigger a level sweep.
  SOURce:SWEep:LEVel:Run

- Run level sweep query (SOURce:SWEep:LEVel:Run?)
  This command starts a level sweep with the previously configured parameters. Additionally, the current level and a status byte are returned for every step. The description of the status byte can be found in table 5.6.2.
  SOURce:SWEep:LEVel:Run?
  -30.0,0

- Abort level sweep (SOURce:SWEep:LEVel:ABOrt)
  The ABOrt command cancels a currently running level sweep and switches the synthesizer output back to a continuous wave (if no modulation is selected).
  SOURce:SWEep:LEVel:ABOrt

- Set the start level (SOURce:SWEep:LEVel:STARt)
  This command sets the start level of a level sweep in dBm.
  SOURce:SWEep:LEVel:STARt -40 dBm

- Set the stop level (SOURce:SWEep:LEVel:STOP)
  This command sets the stop level of a level sweep in dBm.
  SOURce:SWEep:LEVel:STOP 5 dBm

- Set the step width (SOURce:SWEep:LEVel:STEp)
  This command sets the step width for each level step during a sweep in dBm.
  SOURce:SWEep:LEVel:STEp 0.5 dBm

- Continuous sweep setup (SOURce:SWEep:CONTinuous)
  If this option is set, the frequency or level sweep is running continuously. After reaching the stop frequency/level the sweep is restarted. The following arguments to this command are accepted:
  • true|false
  • yes|no
  • 1|0
  • on|off
  SOURce:SWEep:LEVel:CONTinuous on

- Trigger setup (SOURce:SWEep:TRIGger)
  There are two ways to trigger each sweep step when running a sweep:
  1. internal trigger (wait for the configured dwell time)
  2. external trigger (use the trigger input on the rear panel)
  The following arguments to this command are accepted:
  • int|ext
  • intern|extern
  • internal|external
  SOURce:SWEep:LEVel:TRIGger external

6.2.5. Modulation parameters (SOURce:MODulation)

The SOURce:MODulation node contains all parameters that are required to set up a modulated output signal. The NSG 4070 supports amplitude modulation, pulse modulation, and external amplitude modulation.

- Modulation mode setup (SOURce:MODulation:MODE)
  This command determines the kind of modulation which is applied to the output signal. The following arguments to this command are accepted:
  AM – Amplitude Modulation
  Pulse – Pulse Modulation
  Ext – External AM
  Off – unmodulated CW signal
  SOURce:MODulation:MODE AM

- AM parameters setup (SOURce:MODulation:AM)
  This mode contains the commands to configure an AM modulated signal.

- AM frequency setup (SOURce:MODulation:AM:FREQuency)
  This command sets the modulation frequency.
  SOURce:MODulation:AM:FREQuency 1 khz

- AM depth setup (SOURce:MODulation:AM:DEPth)
  This command sets the modulation depth in percent.
  SOURce:MODulation:AM:DEPth 80

- Pulse parameters setup (SOURce:MODulation:PULSE)
  This mode contains the commands to configure a pulse modulated signal.

- Pulse frequency setup (SOURce:MODulation:PULSE:FREQuency)
  This command sets the modulation frequency.
  SOURce:MODulation:PULSE:FREQuency 2 hz

- Pulse duty cycle setup (SOURce:MODulation:PULSE:DUTY)
  This command sets the duty cycle of the pulse modulation in percent.
  SOURce:MODulation:PULSE:DUTY 50

6.3. The power meter subsystem

The POWERmeter subsystem contains remote control commands to read the power meter channels of the NSG 4070. The device provides 3 external channels and 1 internal channel that is used to measure the forward power on the amplifier output.

6.3.1. Channel 1 (POWERmeter:CHannel1?)

Measures the power on channel 1 of the built in power meter. A value in dBm is returned.

POWERmeter:CHannel1?
-12.33 DBM

6.3.2. Channel 2 (POWERmeter:CHannel2?)

Measures the power on channel 2 of the built in power meter. A value in dBm is returned.

POWERmeter:CHannel2?
5.23 DBM

6.3.3. Channel 3 (POWERmeter:CHannel3?)

Measures the power on channel 3 of the built in power meter. A value in dBm is returned.

POWERmeter:CHannel3?
0.57 DBM

6.3.4. Forward power (POWERmeter:FORWard?)

Measures the forward power on the amplifier output of the NSG 4070. A value in dBm is returned.

POWERmeter:FORWard?
25.23 DBM

6.4. The amplifier subsystem

6.4.1. Amplifier On/Off (AMPlifier)

Turns the internal amplifier on or off when the device is used in generator mode.

AMPlifier on

6.5. The monitor subsystem

The MONitor subsystem contains remote control commands that let the user read in the various monitoring inputs. Additionally the user can set the digital outputs on the user port (user output 0-3) to the desired TTL level.

6.5.1. Analog input (MONitor:ANAlog?)

Reads in the voltage on the analog input on the rear panel of the NSG 4070. A value in Volts is returned.

MONitor:ANAlog?
3.33 V

6.5.2. Digital input (MONitor:DIGital?)

Reads all digital inputs on the rear panel of the NSG 4070 and returns a byte with a bit for each input set. Please see Table 7 for the structure of the returned byte. See Chapter 3.2.2 Back panel for the pin assignment of the user port.

MONitor:DIGital?
12

Bit	Input
0	User Input 0
1	User Input 1
2	User Input 2
3	User Input 3
4	Digital 1
5	Digital 2
6	Optical Input

Table 7: Digital monitoring inputs

6.5.3. Digital outputs

The NSG 4070 has 4 digital outputs which can be used for control purposes when the device is embedded in a test bench. These outputs are user output 0-3 on the user port. They can be set to TTL level.
The following arguments are accepted: high/low, on/off, 1/0, true/false, yes/no and auto.
The function Auto is explained in chapter 7. See Chapter 3.2.2 Back panel for the pin assignment of the user port.

- User output 0 (MONitor:UserOUT0)
  Sets the user output 0 to the desired level.
  MONitor:UserOUT0 high

- User output 1 (MONitor:UserOUT1)
  Sets the user output 1 to the desired level.
  MONitor:UserOUT1 high

- User output 2 (MONitor:UserOUT2)
  Sets the user output 2 to the desired level.
  MONitor:UserOUT2 high

- User output 3 (MONitor:UserOUT3)
  Sets the user output 3 to the desired level.
  MONitor:UserOUT3 high

6.6. The MISCellaneous subsystem

The MISCellaneous subsystem contains remote control commands that are useful but may not fit into other subsystems. Most of the commands in this node yield information about files stored on the device.

6.6.1. File information

Some commands that deliver useful information about files stored on the NSG 4070:

- List system calibration files (MISCellaneous:FILES:CALibration?)
  This command returns all calibration files available on the device. The individual file names are separated with a semicolon ";".
  MISCellaneous:FILES:CALibration?
  cdn.cal;emclamp.cal;foo.cal;bar.cal

- List probe calibration files (MISCellaneous:FILES:MONitoring?)
  This command returns all monitoring probe calibration files available on the device. The individual file names are separated with a semicolon ";".
  MISCellaneous:FILES:MONitoring?
  probe1.mon;foo.mon;bar.mon

- List result files (MISCellaneous:FILES:RESult?)
  This command returns all result files available on the device. The individual file names are separated with a semicolon ";".
  MISCellaneous:FILES:RESult?
  foo.res;bar.res

- List config files (MISCellaneous:FILES:CONFig?)
  This command returns all configuration files available on the device. The individual file names are separated with a semicolon ";". Alternatively MISCellaneous:FILES:CFG? can be used.
  MISCellaneous:FILES:CFG?
  foo.cfg;bar.cfg

- Get file comment (MISCellaneous:FILES:COMMent?)
  This command returns the file comment for a particular file.
  MISCellaneous:FILES:COMMent? foo.cfg
  This cfg is for IEC 61000-4-6 Level 1

- Get amplifier freqency response (MISCellaneous:AMPlifier?)
  This command returns the frequency response of the internal amplifier in the following format: frequency[Hz],gain[dB];frequency[Hz],gain[dB]...
  The string ends with a newline character. Note: There is no newline character between the separate nodes.
  MISCellaneous:AMPlifier?
  9000,-19.34;...;1000000,54.12;...;230000000,53.34;new line

- Get directional coupler coupling factor (MISCellaneous:DIRectionalCOUPler?)
  This command returns the coupling factor over frequency of the internal directional coupler in the following format: frequency[Hz],loss[dB];frequency[Hz],loss[dB]...
  The string ends with a newline character. Note: There is no newline character between the separate nodes.
  MISCellaneous:DIRCOUP?
  9000,40.34;...;1000000,37.12;new line

7. ADVANCED USE OF EUT MONITORING PORTS

7.1. Digital outputs

The NSG 4070 has 4 digital outputs which can be used for control purposes when the device is embedded in a EUT monitoring setup. These outputs are supplied on user port pin 6 to 9. In local operation mode the unit works in “auto” mode. A default behavior is applied to these outputs during an immunity test. In remote operation mode the unit can be set to either “high”, “low” or “auto” mode.

7.1.1. “Auto” mode

This mode provides a “high” level on User port output 0 during the dwell time and falls to “low” level only during the setting time for the next frequency. The timing is shown in the next figure:

① **Frequency setting time, typical 50 ms**
② **Dwell time, depends on parameter “Dwell time“, typical 1 s**
③ **Scan EUT monitoring ports, typical 1 ms**

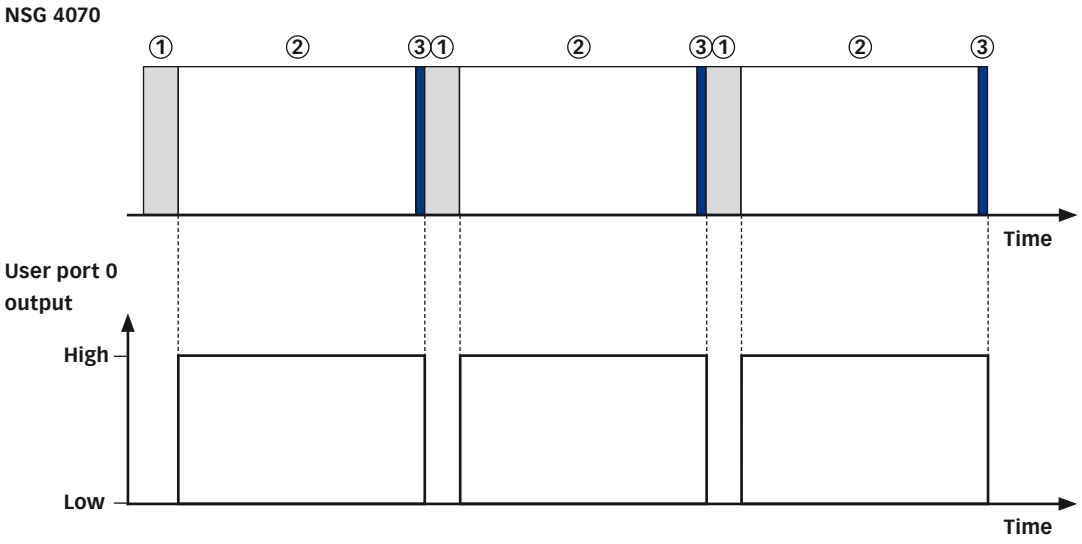


Figure 9: Timing of User port 0 output in “auto“ mode

8. APPLICATIONS

8.1. Introduction

The modular setup of the device and its frequency range up to 1 GHz allow a wide variety of applications. The main application is the conducted immunity; however, the signal generator and the power meter up to 1 GHz can also be used for any other application with internal or external amplifiers

8.2. IEC/EN 61000-4-6 testing

8.2.1. Test level setting and test setup calibration

The test generator is connected via a 6 dB attenuator to the RF port of the coupling device. The EUT port of the coupling device is connected in common mode through the 150 Ω to 50 Ω adapter to a power meter with 50 Ω input impedance. The AE port is terminated with 150 Ω. The setup for level setting (also called calibration) is shown as an example in the figure below:

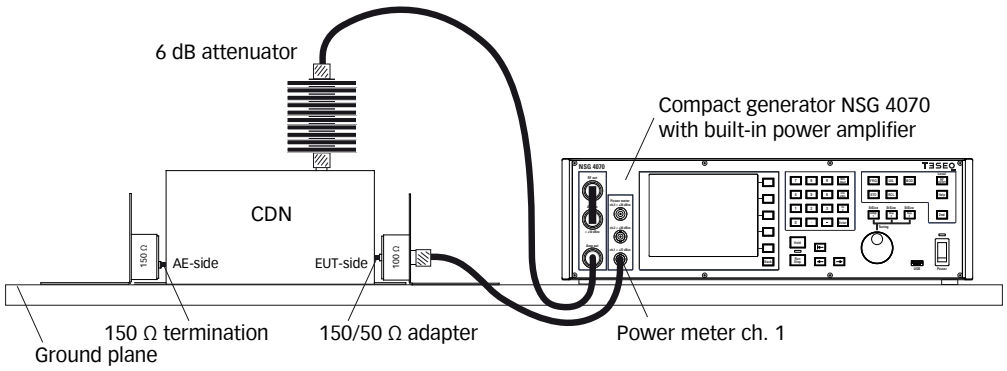


Figure 10: Setup for level setting at the EUT port of coupling/decoupling devices

8.2.2. Test level of IEC/EN 61000-4-6 third edition

U_0 the open-circuit test levels (e.m.f.) of the unmodulated disturbing signal, expressed in r.m.s. are 1 V, 3 V or 10 V. The test levels are set at the EUT port of the coupling devices.
For equipment testing, this signal is 80 % amplitude modulated with a 1 kHz sine wave to simulate actual threats.

$U_{mr} = U_0/6 \pm 25$ %, in linear quantities, or
$U_{mr} = U_0 - 15.6$ dB ± 2 dB in logarithmic quantities.

NOTE 1: U_0 is the unmodulated disturbing signal and U_{mr} is the measured voltage. To minimize testing errors, the output level of the test generator is set by setting U_{mr} loads with 150 Ω and not by setting U_0.
NOTE 2: The factor 6 (15.6 dB) arises from the e.m.f. value specified for the test level. The matched load level is half the e.m.f. level and the further 3:1 voltage division is caused by the 150 Ω to 50 Ω adapter terminated by the 50 Ω measuring equipment.

Setup for level setting, equivalent circuit diagram

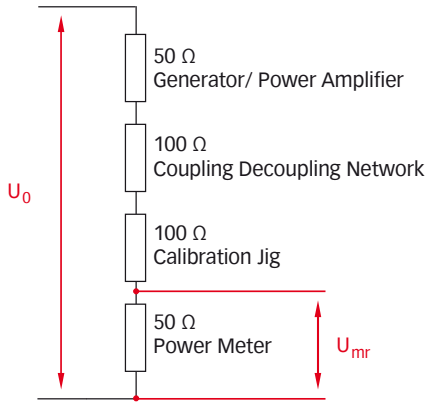


Figure 11: Equivalent circuit diagram

$$\frac{U_{mr}}{U_0} = \frac{50}{50+100+100+50}$$

Measured voltage $U_{mr} = \frac{U_0}{6}$

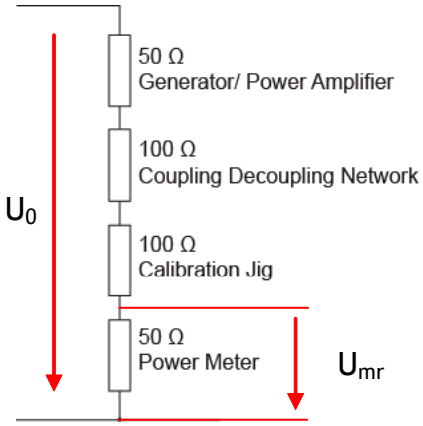
Test level in V_{EMF}	Measured voltage in V_{mr}	Measured power in dBm
1	0.1667	-2.55
3	0.5	6.99
10	1.667	17.45

Table 8: Test level and measured voltage

Amplifier module:	**20 W**	**30 W**	**75 W**
CDN:	15 V EMF	18 V EMF	30 V EMF
EM-clamp (KEMZ 801):	8 V EMF	11 V EMF	17 V EMF
Current injection clamp (CIP 9136):	5 V EMF	6 V EMF	10 V EMF (typ.)

Table 9: Power amplifier recommendation
(achievable test levels with 6 dB attenuator, 0.5 dB cable loss, max. insertion loss of the coupling device and AM with 80% modulation depth)

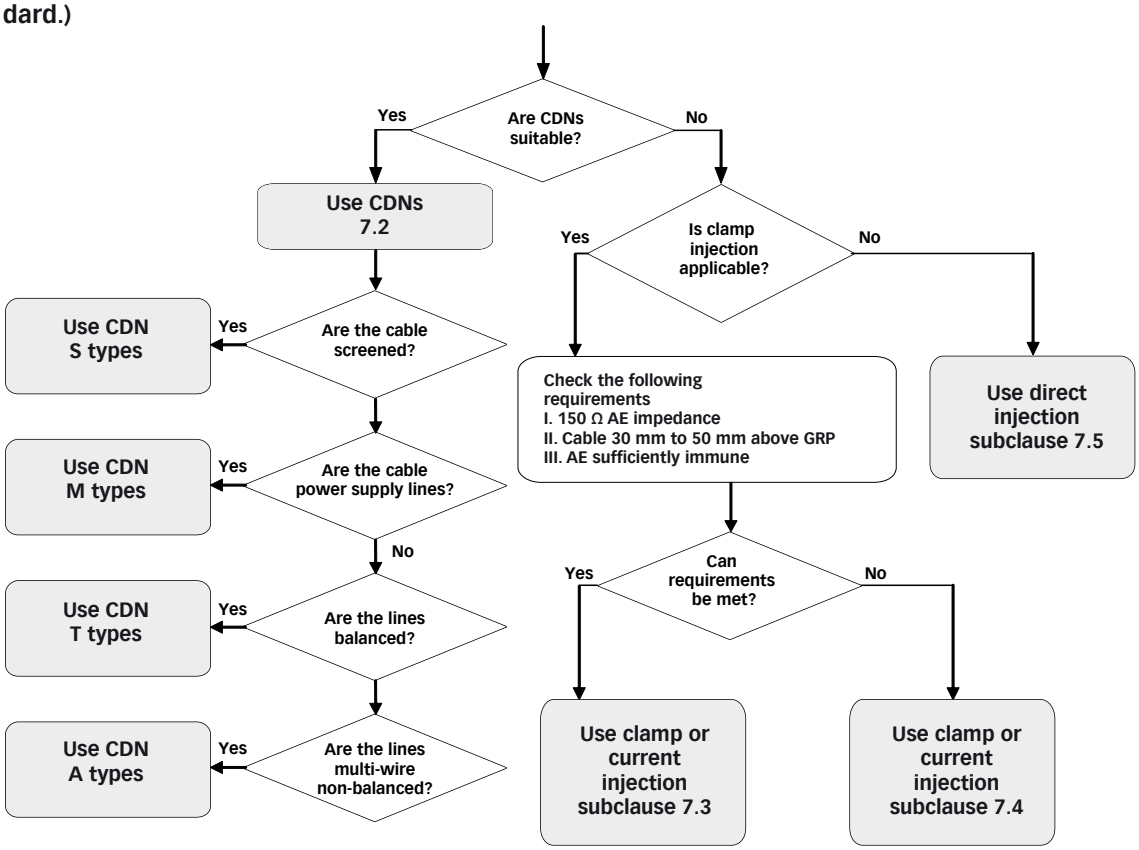
Setup for level setting, equivalent circuit diagram



$$\frac{U_{mr}}{U_0} = \frac{50}{50+100+100+50}$$

$$U_{mr} = \frac{U_0}{6}$$

Rules for selecting the injection method (Chapters 7.2 to 7.5 refer to the IEC/EN 61000-4-6 standard.)



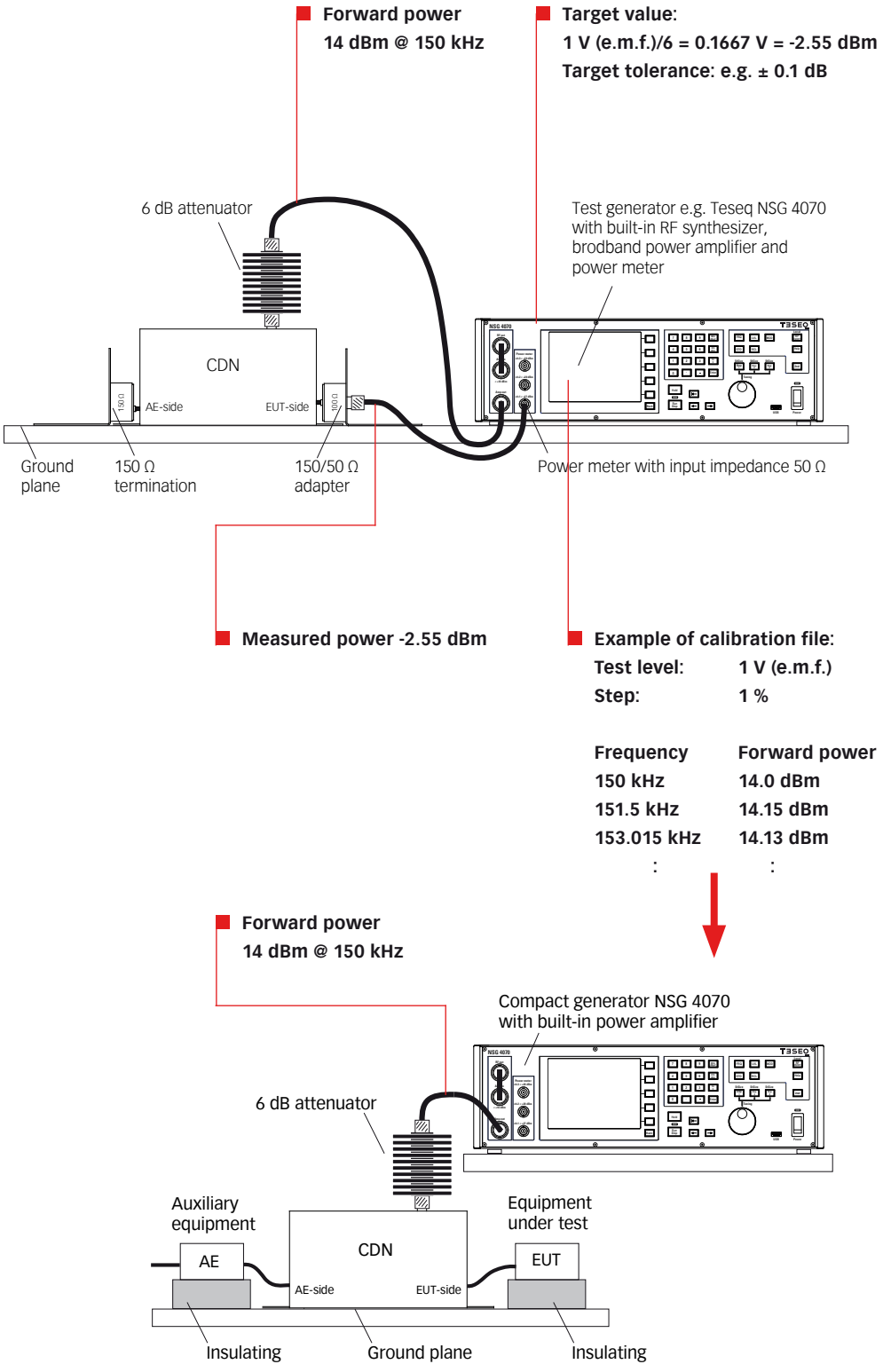


Figure 12: Example for test level setting, relation between test level and measured level (The influence of the modulation is neglected in this sample.)

8.2.4. Test setup calibration with a CDN

The calibration setup always refers to the type of CDN. The CDN user manuals and the NSG 4070 Control Program show the required setup. (Immunity Menu/Global setup/Show test setup pictures). Examples for the test setup calibration of CDN M016 and CDN S900 are shown below:

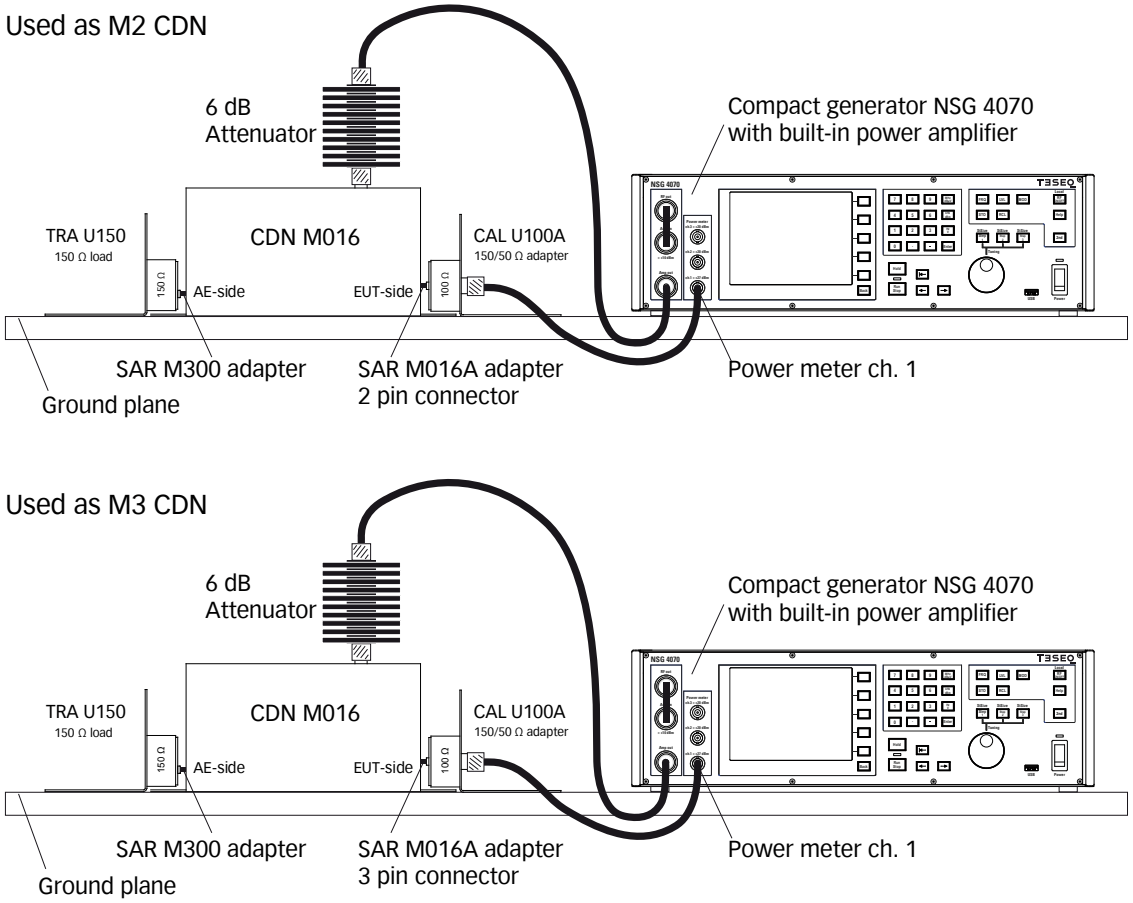


Figure 13: Test setup calibration with CDN M016 (switchable M2/M3)

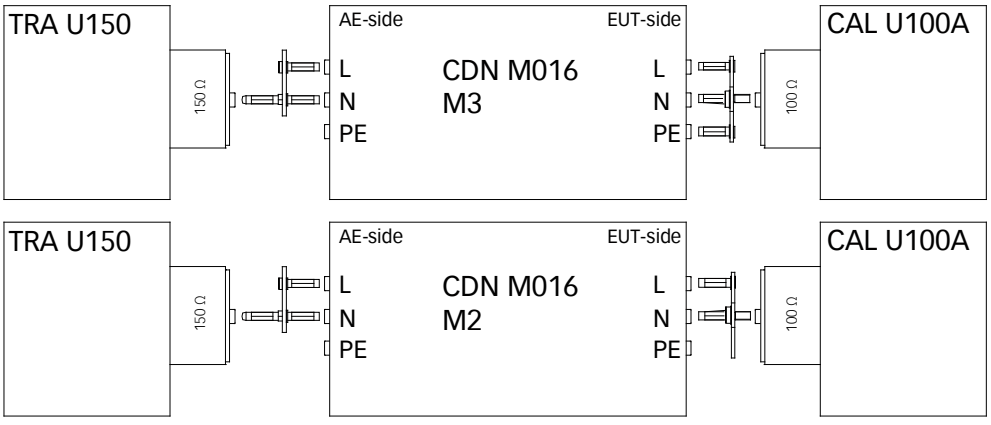


Figure 14: Setup details with CDN M016

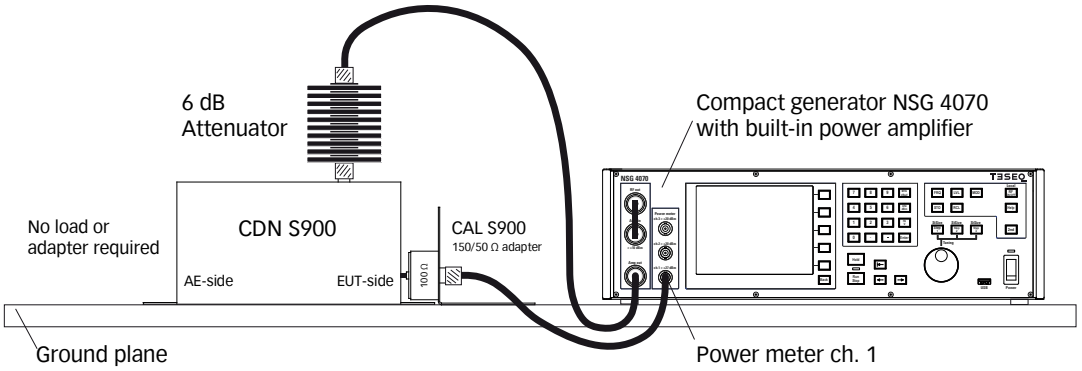


Figure 15: Test setup calibration with CDN S900

8.2.5. EUT test setup with CDN

After calibration the 150 Ω to 50 Ω adapter/ 150 Ω load has to be removed from the setup. The EUT must be connected through the CDN. One general example for the test setup with EUT is shown below:

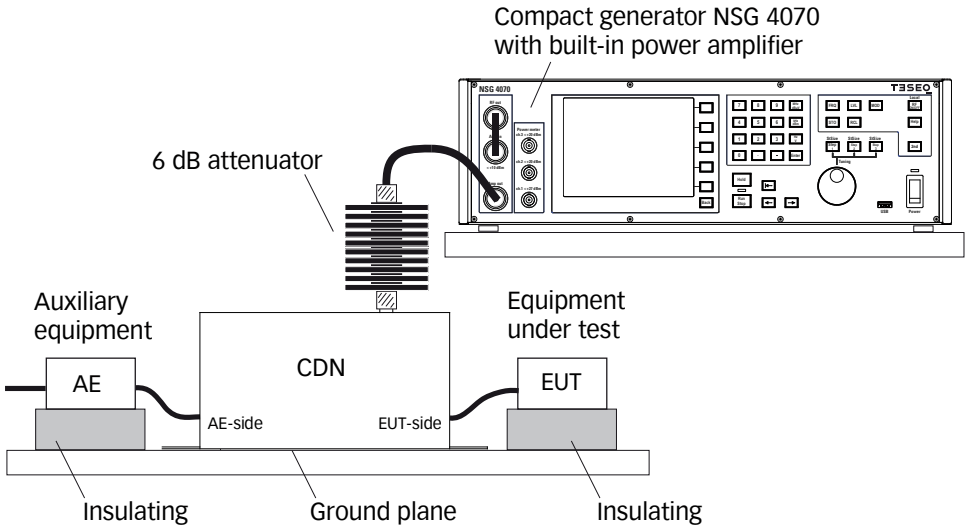


Figure 16: Test setup with EUT

8.2.6. Test setup calibration with EM-clamp

The test generator is connected via a 6 dB attenuator to the RF port of the EM-clamp. The EUT port of the EM-clamp is connected in common mode through the 150 Ω to 50 Ω adapter to a power meter with 50 Ω input impedance. The AE port is terminated with 150 Ω. The setup for level setting (also called calibration) is shown in figure below:

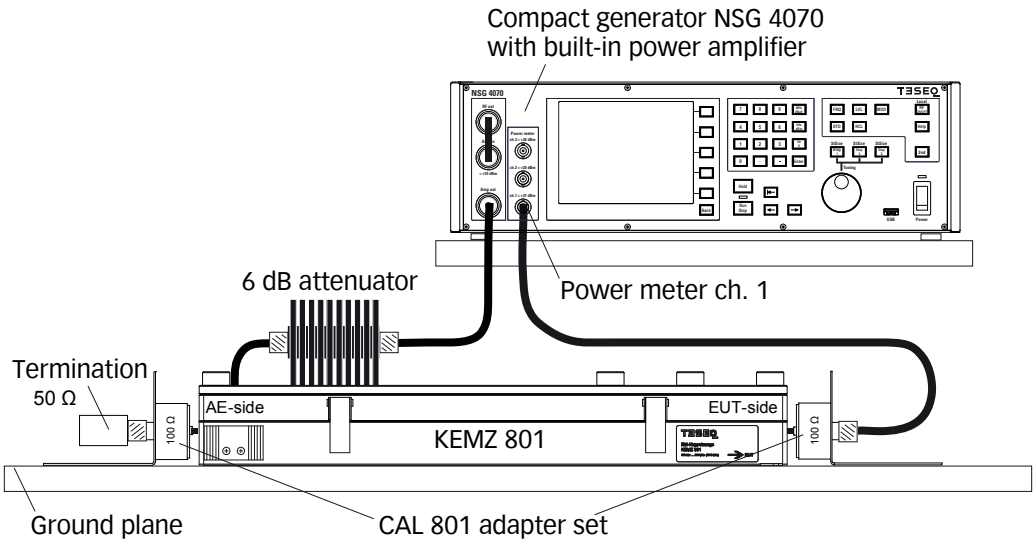


Figure 17: Test setup calibration according IEC/EN 61000-4-6 with EM-clamp

8.2.7. EUT test setup with EM clamp

After calibration the 150 Ω to 50 Ω adapter/ 150 Ω load has to be removed from the setup. The EUT must be connected through the EM clamp. One general example for the test setup with EUT is shown below:

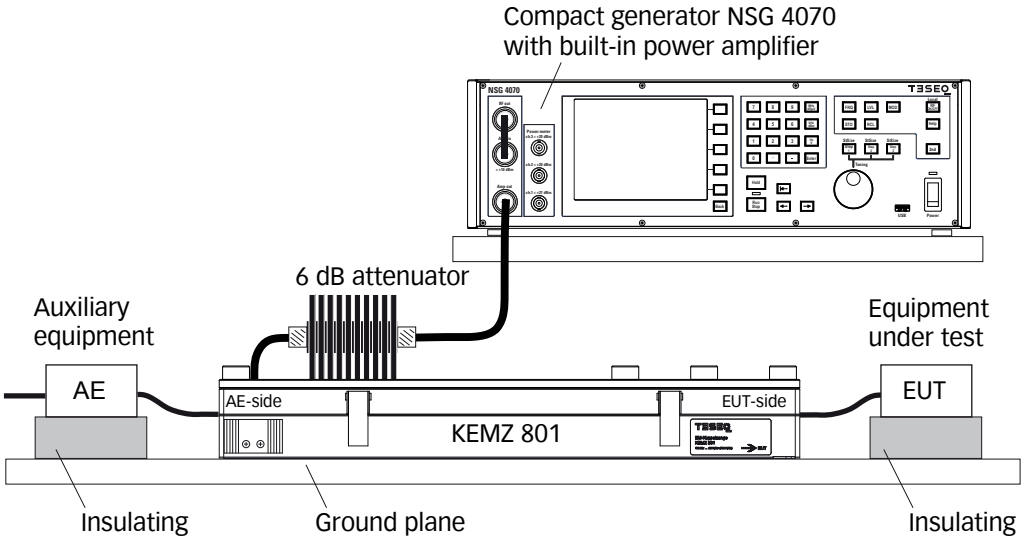


Figure 18: Test setup with EUT according IEC/EN 61000-4-6 with EM-clamp

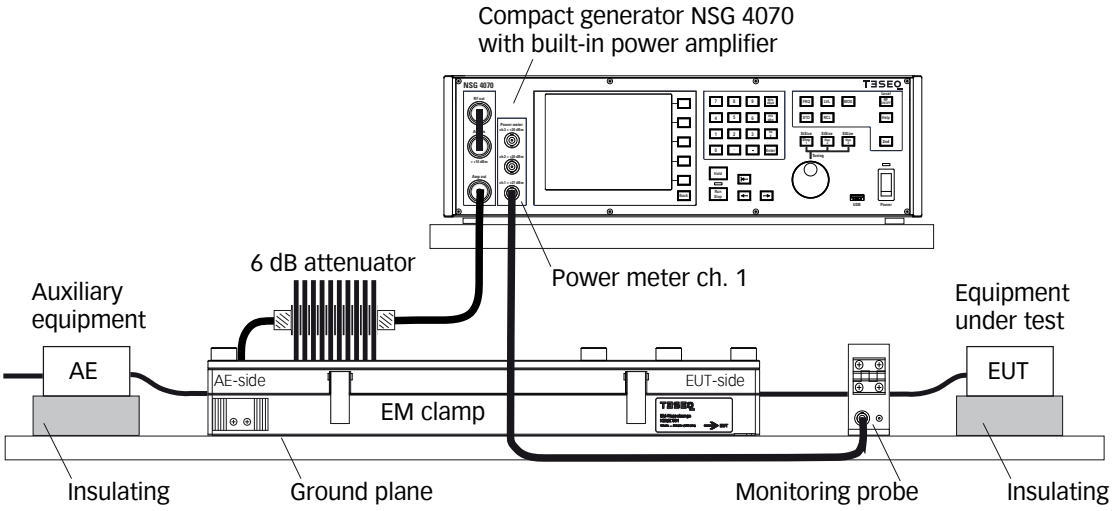


Figure 19: Test setup with EUT according IEC/EN 61000-4-6 with EM-clamp and monitoring probe

8.2.8. Test setup calibration with current injection clamp

The test generator is connected via 6 dB attenuator to the RF port of the current injection clamp. The clamp is inserted in a 50 Ω jig. The jig is connected with a 150 Ω to 50 Ω adapter to a power meter with 50 Ω input impedance. The other side of the jig is terminated with 150 Ω. The setup for level setting (also called calibration) is shown in the figure below:

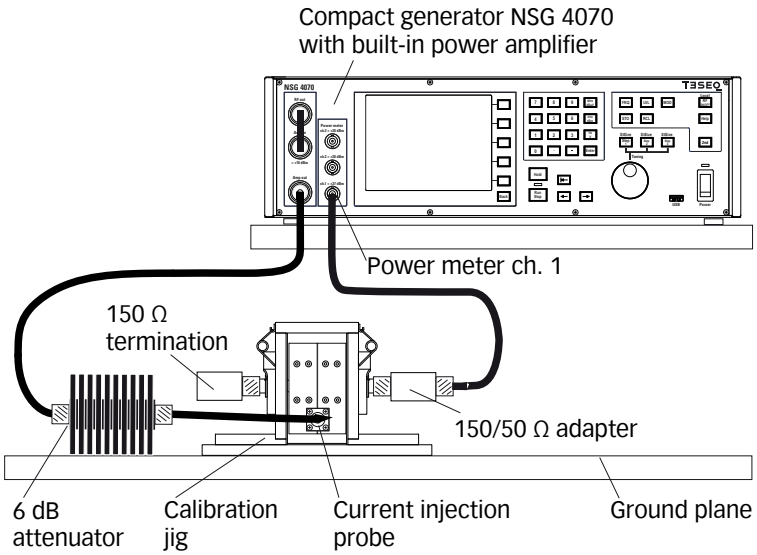


Figure 20: Test setup calibration according IEC/EN 61000-4-6 with current injection clamp

8.2.9. EUT test setup with current injection clamp

After calibration the jig and the adapters must be removed from the setup. The EUT must be connected through the current injection probe. A general example for the test setup with EUT is shown below:

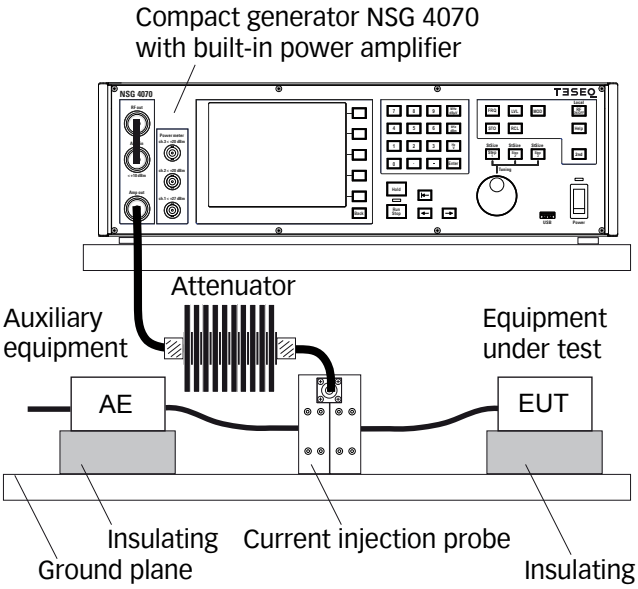


Figure 21: Test setup with EUT according IEC/EN 61000-4-6 with current injection clamp

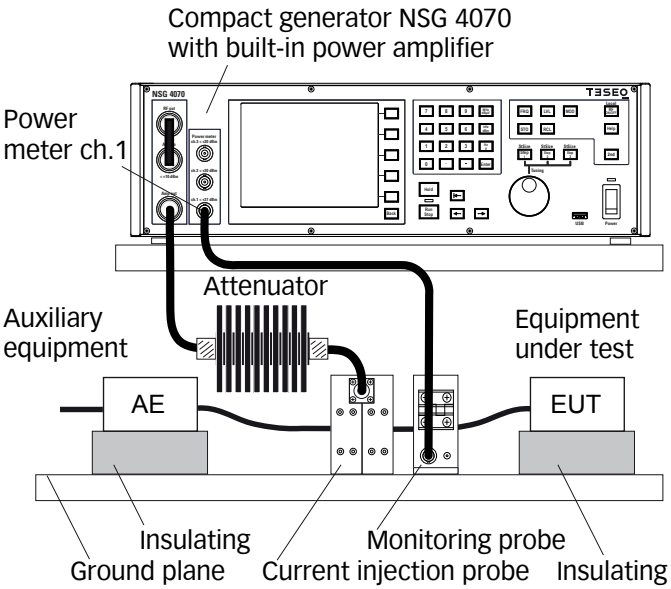


Figure 22: Test setup with EUT according IEC/EN 61000-4-6 with current injection clamp and monitoring probe

8.2.10. Calibration of the monitoring probe

Teseq recommends using the MD 4070 monitoring probe due to the operating range of the power meter. The power supply of the MD 4070 is not shown in the figure. The MD 4070 needs to be calibrated in the active and passive mode to make full use of its working range. The required mode is determined by the stress level. See Table 10 for details.

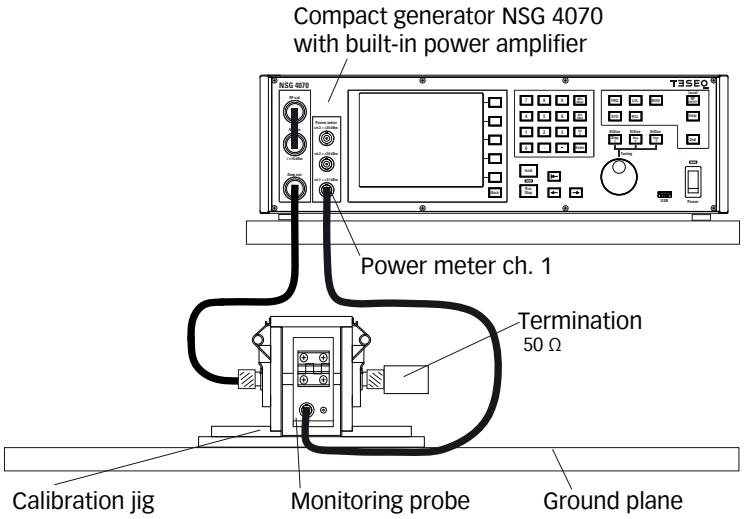


Figure 23: Calibration setup of the monitoring probe

The calibration setup for the monitoring probe with an external power amplifier is shown below.

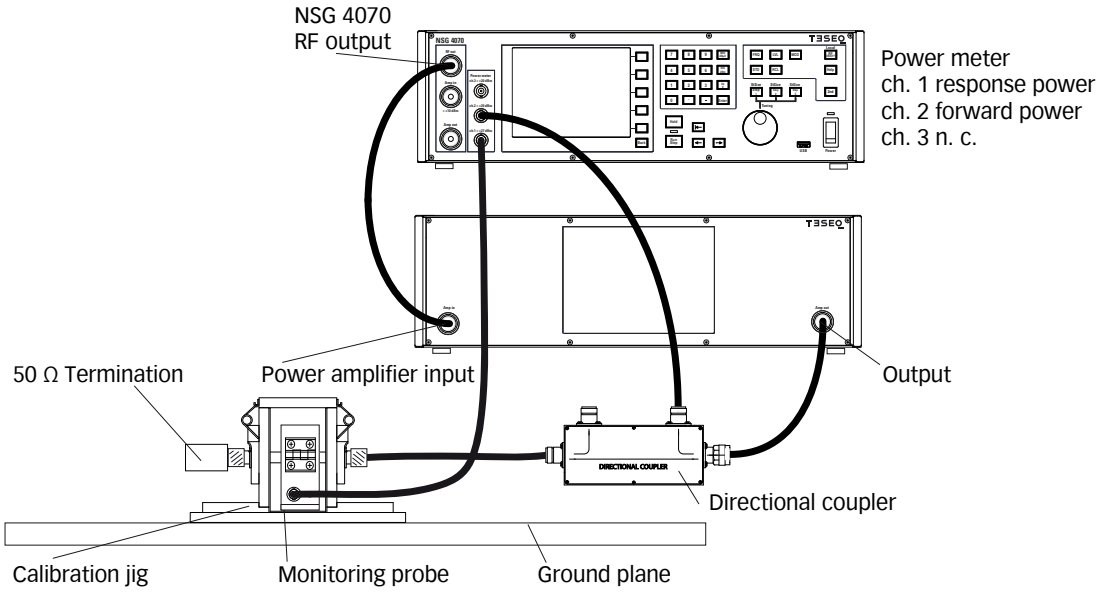


Figure 24: Calibration setup of the monitoring probe with external power amplifier and directional coupler

Monitor probe	Stress level****
Insertion loss in dB	V EMF
+10*	1 to 3
-22**	3 to 30
-34***	12 to 30

* typical MD 4070 active

** typical MD 4070 passive

*** current probe with transfer impedance 1 Ω (0 dB/ Ω)

**** lower limit 1 V EMF and upper limit 30 V EMF are given by the NSG 4070

Table 10: Insertion loss of the probe relative to power meter range and stress level

The calibration of the MD 4070 in active mode requires using a 10 dB or 20 dB attenuator on power meter channel 1. This is related to the type of the external directional coupler. The 40 dB type requires an attenuator. Chapters 4.3.4 (front panel operation) and 5.9.3.7 (NSG 4070 Control software operation) describe the entry of the attenuation factor.

8.2.11. Setup with external power amplifier and directional coupler

An external power amplifier can be connected to the NSG 4070 as shown in the general example below. An external power amplifier and external directional coupler are always required regardless of the type of NSG 4070 used.

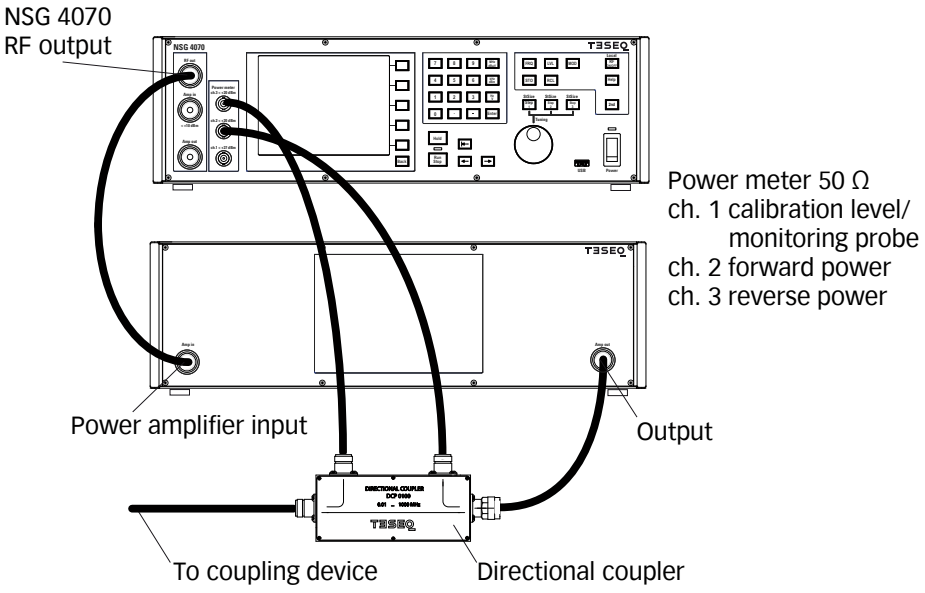


Figure 25: Setup with external power amplifier and directional coupler

8.3. Automotive BCI testing

8.3.1. Standards

The automotive industry has a range of test standards separate from those used in commercial immunity testing. ISO (the International Organization for Standardization) defines the standard in ISO 11452-4: Road vehicles: Component test methods for electrical disturbances from narrowband radiated electromagnetic energy: Part 4: Bulk current injection (BCI). Individual automotive manufacturers use this basic standard as a guide to produce their own individual test standards. Thus each car manufacturer may have some variants to the ISO 11452-4 requirements which are not addressed in this chapter.

8.3.2. Differences between IEC/EN 61000-4-6 and BCI

	IEC/EN 61000-4-6	BCI
Frequency range	150 kHz … 80 (230) MHz	(10 kHz) 1 MHz … 400 (1000) MHz
System	150 Ω	50 Ω
Stress level	Voltage EMF	Current in mA or dBµA
Modulation	AM	AM PC (Peak conservation)
Frequency step	max. 1 % of the preceding frequency value	e.g. as shown in ISO 11452-1 table 2
Test method	Substitution (with power limitation in case the 150 Ω condition cannot be meet)	Substitution method Substitution method (current measurement probe use is optional) Closed loop with power limitation
Additional equipment	6 dB attenuator	Reverse power measurement

Table 11: Differences between IEC/EN 61000-4-6 and BCI

8.3.3. Stress level

The standard ISO 11452-4 defines the range from 25 to 100 mA. Specific values, also above 100 mA, can be defined by the users of the standard, if necessary.

8.3.4. Modulation

In the automotive standards the peak of the modulation envelope is at the same level as the peak of the CW signal and so no allowance needs to be made for modulation. This kind of modulation is called AM PC (peak conservation) and can be selected in the menu-controlled operation of the NSG 4070 or in the Windows NSG 4070 Control software.

8.3.5. Calibration

All BCI test methods are based upon the use of forward power as the reference parameter. The specific test level (current) shall be calibrated by recording the forward power required to produce a specific current measured on a 50 Ω calibration jig for each test frequency. This calibration shall be performed with an unmodulated sinusoidal wave. An example calibration setup is shown in the figure below:

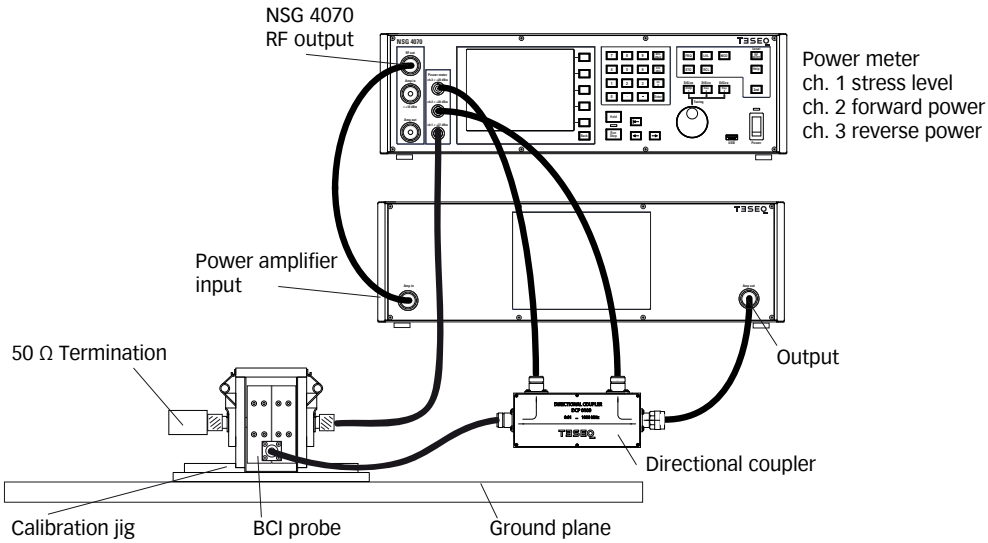


Figure 26: BCI calibration setup

Stress level			
mA	dBµA	dBm	W
1	60	-13	0.00005
4	72	-1	0.0008
10	80	7	0.005
25	88	15	0.032
45	93	20	0.1
100	100	27	0.5
200	106	33	2.0
317	110	37	5.0
400	112	39	8
502	114	41	12.6

Table 12: Stress level conversion

The calibration jig should be terminated by a 50 Ω load at one end and by a 50 Ω RF power meter at the other end. The power meter must be protected by an adequate 50 Ω attenuator in case the stress level exceeds 100 mA (106 dBµA) (see the yellow marked range in Table 12)

The power requirements for the 50 Ω load are on the same level as the stress level (see Table 12). For example: A stress level of 400 mA requires at least a 8 W attenuator.

Calibration of the monitoring probe

Teseq recommends using the MD 4070 monitoring probe due to the operating range of the power meter. The following figure shows the setup for the probe calibration. The table below provides the probe insertion loss relative to power meter range and stress level.

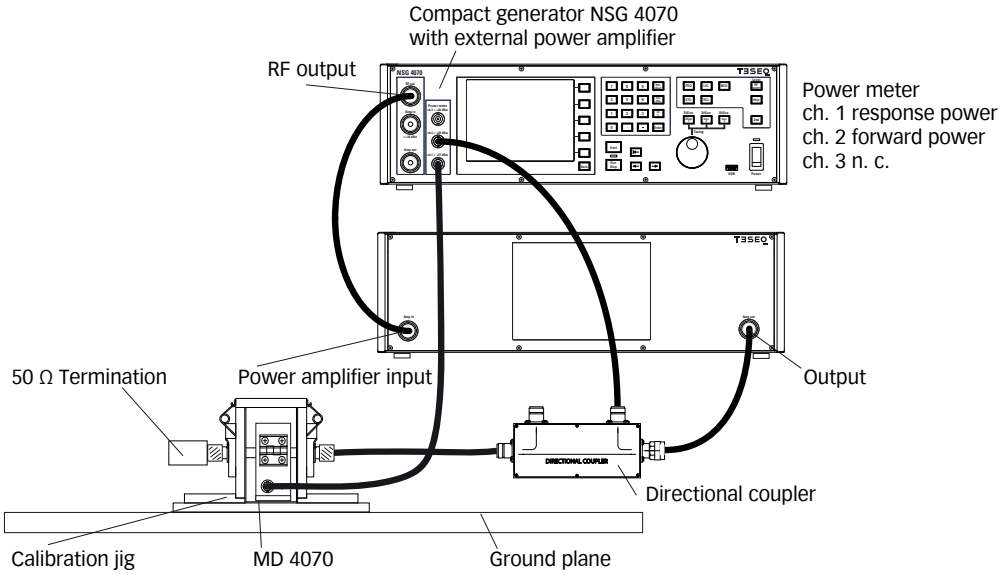


Figure 27: Probe calibration setup

Monitor probe	Stress level range (calculated with power limitation factor 4)	
Insertion loss in dB	mA	dBµA
+10*	0.3 to 16	50 to 84
-22**	10 to 500	80 to 114
-34***	40 to 2500****	92 to 128

* typical MD 4070 active
** typical MD 4070 passive
*** current probe with transfer impedance 1 Ω (0 dB/ Ω)
**** typical limit at 1000 mA caused by the probe

Table 13: Probe insertion loss relative to power meter range and stress level

The calibration of the MD 4070 in active mode requires using a 10 dB or 20 dB attenuator on power meter channel 1. This is related to the type of directional coupler. The 40 dB type requires an attenuator. Chapters 4.3.4 (front panel operation) and 5.9.3.7 (NSG 4070 Control software operation) describe the entry of the attenuation factor.

8.3.6. Test setup

After calibration the jig must be removed from the setup. The EUT must be connected through the BCI probe. A general example of the test setup for the substitution method without current monitoring probe is shown in Figure 28. Figure 29 shows the setup for the substitution method with current monitoring probe for the Closed loop method. See Chapter 8.2.10 for current monitoring probe calibration.

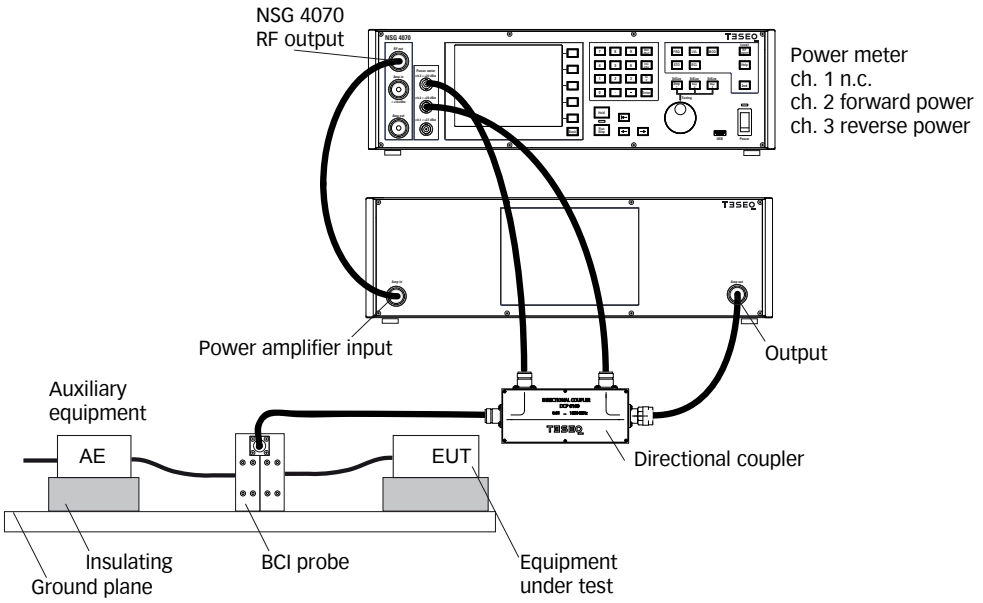


Figure 28: BCI test setup without current monitoring probe

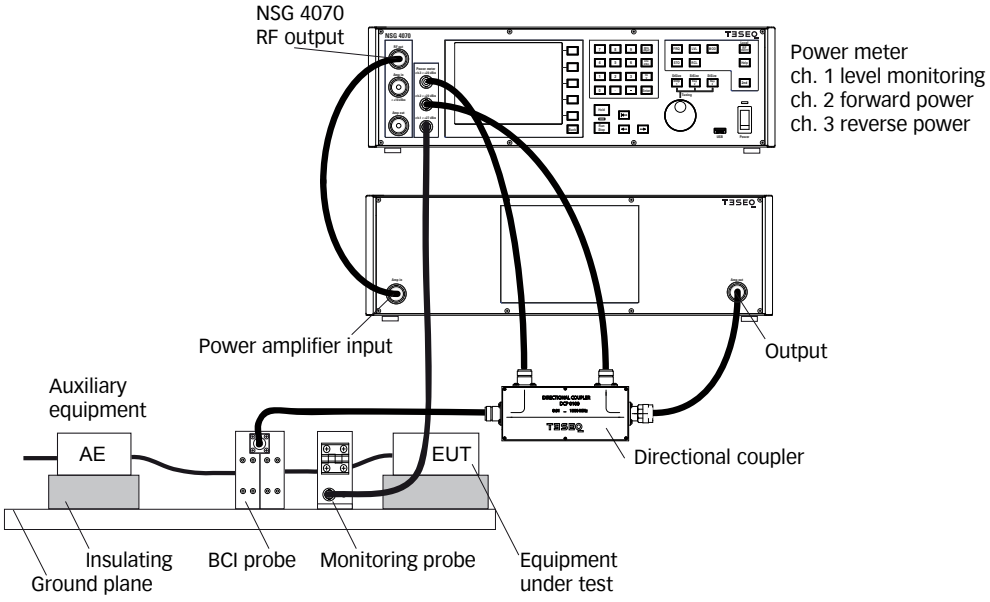


Figure 29: BCI test setup with current monitoring probe

8.3.7. Power limitation factor

The standard ISO 11452-4 defines a power limit for the Closed loop method. The test procedure used at each frequency is described as follows. Increase the forward power applied to the current injection probe and measure the injected current until either:

- the measured current reaches the specified test level, or
- the forward power reaches the power limit.

The value $P_{for\ cal.}$ is known from the calibration procedure. The power limit is shown as:

$$\mathbf{P_{CW\ limit} = kP_{for\ cal}}$$

$P_{CW\ limit}$ is the power limit
$P_{for\ cal.}$ is the forward power applied to reach the current test signal level in the jig
k limitation factor (default value is 4)

The limitation factor of 4 requires 4 times higher forward power as calibrated. The power amplifier must be able to have this reserve. The connected hardware (directional coupler, power meter, attenuator and BCI probe) should be selected for the maximum level of the power amplifier.

8.3.8. Power requirements

Stress level	Insertion loss CIP 9136A typ. max. value 10 to 100 kHz	Required forward power (CW)	Insertion loss CIP 9136A typ. max. value 100 kHz to 1 MHz	Required forward power (CW)	Insertion loss CIP 9136A typ. max. value 1 to 400 MHz	Required forward power (CW)
dBµA	dB	Watts	dB	Watts	dB	Watts
64	27	0.1	15	0.01	10	0.002
70	27	0.3	15	0.02	10	0.006
89	27	25.1	15	1.6	10	0.5
95	27	100.0	15	6.3	10	2.0
100	27	316.2	15	20.0	10	6.3
106	27	limit	15	79.4	10	25.1
109	27	limit	15	158.5	10	50.1

Table 14: Power requirements for stress levels in dBµA (calculated with 1 dB cable loss)

Stress level	Insertion loss CIP 9136A typ. max. value 10 to 100 kHz	Required forward power (CW)	Required forward power (CW) for k=4	Insertion loss CIP 9136A typ. max. value 100 kHz to 1 MHz	Required forward power (CW)	Required forward power (CW) for k=4	Insertion loss CIP 9136A typ. max. value 1 to 400 MHz	Required forward power (CW)	Required forward power (CW) for k=4
mA	dB	Watts	Watts	dB	Watts	Watts	dB	Watts	Watts
25	27	19.7	78.9	15	1.2	5.0	10	0.4	1.6
50	27	78.9	315.5	15	5.0	19.9	10	1.6	6.3
75	27	177.5	709.8	15	11.2	44.8	10	3.5	14.2
100	27	315.5	limit	15	19.9	79.6	10	6.3	25.2
150	27	709.8	limit	15	44.8	179.1	10	14.2	56.7
200	27	limit	limit	15	79.6	318.5	10	25.2	100.7
250	27	limit	limit	15	124.4	497.6	10	39.3	157.4
300	27	limit	limit	15	179.1	716.6	10	56.7	226.6
400	27	limit	limit	15	318.5	limit	10	100.7	402.9
500	27	limit	limit	15	497.6	limit	10	157.4	629.5

Table 15: Power requirements for stress levels in mA (calculated with 1 dB cable loss)

8.4. Radiated testing

8.4.1. General

The NSG 4070's wide frequency range from 9 kHz to 1 GHz allows it to also be used for radiated immunity tests. Its modular setup using external amplifiers and directional couplers enables a large variety of applications, including tests according to IEC/EN 61000-4-3, IEC/EN 61000-4-20, IEC/EN 61000-4-21 and others. The NSG 4070 can be remote controlled with optionally available test house software for convenient and efficient operation.

8.4.2. Examples of test setups

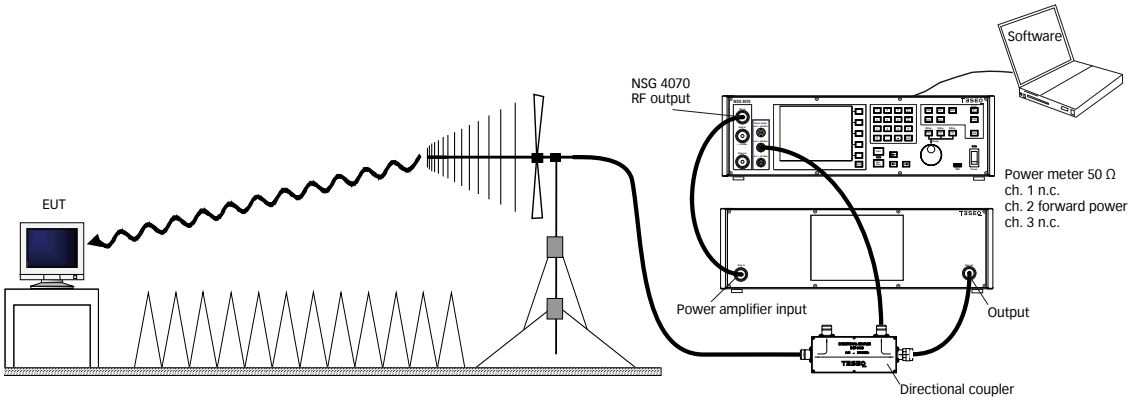


Figure 30: Setup with antenna

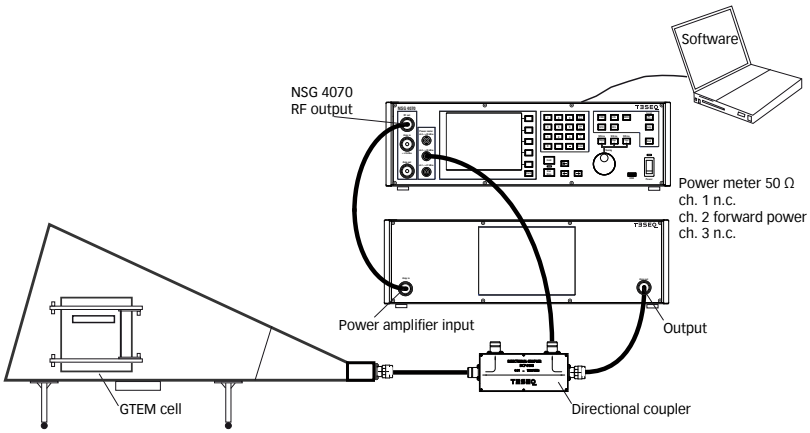


Figure 31: Setup with GTEM cell

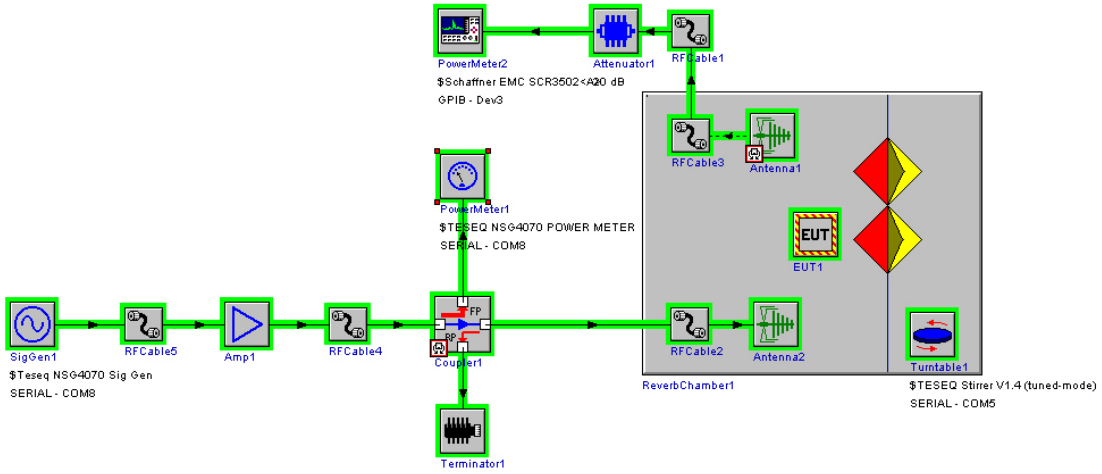


Figure 32: Compliance 3 test house software configuration of a reverberation chamber setup with NSG 4070

9. TECHNICAL SPECIFICATIONS

9.1. Generator

RF	
Frequency range:	9 kHz – 1 GHz
Resolution:	1 Hz
Reference frequency:	10 MHz Reference output
RF Level	
Level range:	-60 dBm to +10 dBm
Resolution:	0.1 dB
Settling time:	10 ms
Amplitude modulation	
Modulation depth:	0 – 100%
Modulation frequency range:	1 Hz – 50 kHz
Frequency resolution:	1 Hz
Pulse modulation	
Rise / fall time (10% / 90%):	< 1 µs
Modulation frequency range:	1 Hz – 50 kHz
Frequency resolution:	1 Hz
Duty cycle:	10% to 90%
External modulation	
Delay time:	< 1 µs / 180°
Period:	min. 20 µs
Pulse width:	min. 10 µs

9.2. Power meter

Frequency range:	9 kHz – 1 GHz
Linear measurement range	
channel 1:	-15 dBm to +27 dBm
channel 2,3:	-25 dBm to +20 dBm
Max. input/no damage	
channel 1-3:	+28 dBm
Noise level:	>6 dB below the measurement range
Input return loss:	>20 dB (below 500 MHz), >17 dB (500 MHz to 1 GHz)
Connector:	BNC socket, 50 Ω
Accuracy	
channel 1:	typ. <0.4 dB
channel 2,3	
below 10 MHz:	range -25 to 17 dBm typ. <0.3 dB
	range 17 to 20 dBm typ. <1.5 dB
above 10 MHz:	typ. <0.4 dB

9.3. Power amplifier

Nominal output power:	20 W	30 W	75 W
Frequency range:	150 kHz – 230 MHz	150 kHz – 230 MHz	150 kHz – 230 MHz
Input impedance:	50 Ω	50 Ω	50 Ω
Output impedance:	50 Ω	50 Ω	50 Ω
Input return loss:	min. 10 dB	min. 10 dB	min. 10 dB
Output return loss:	nominal min. 9.5 dB, 0 dB without damage	nominal min. 9.5 dB, 0 dB without damage	nominal min. 9.5 dB, 0 dB without damage
Gain:	min. 46 dB	min. 46 dB	min. 50 dB
Gain flatness:	max. +/- 3 dB	max. +/- 3 dB	max. +/- 3 dB
Saturated output power:	min. 43 dBm	min. 45 dBm	min. 48.75 dBm
Max. input power linear without damage:	< -3.5 dBm max. +10 dBm	< -1.5 dBm max. +10 dBm	< -3 dBm max. +10 dBm
2nd harmonic distortion at nominal output power:	typ. < -30 dBc	typ. < -30 dBc	typ. < -35 dBc
3rd harmonic distortion at nominal output power:	typ. < -20 dBc	typ. < -20 dBc	typ. < -18 dBc

9.4. Test and measurement routines

9.4.1. Firmware: Generator mode

Sweep:	frequency sweep, level sweep
Modulation:	AM, AM PC (peak conservation), pulse modulation and external
Others:	free parameter setting from 9 kHz to 1 GHz, high power mode using power amplifier

9.4.2. Firmware: Immunity mode

Level:	constant or slope test levels, max test levels depending on power amplifier, test routine for IEC 61000-4-6 level 1 to 3 and X up to 30 V EMF, for BCI tests levels in units mA or dBµA
Test methods IEC 61000-4-6:	CDN, EM clamp, current clamp and direct injection, clamp injection with test level control using monitoring probe
Test methods BCI:	substitution method with optional use of the monitoring probe, Closed loop method with power limitation (factor adjustable)
Sweep:	frequency sweep, sweep function linear, steps per decade, percental and as requested in ISO 11452

Modulation:	AM, AM PC (peak conservation), pulse modulation, external or mixed (e.g. 1 kHz AM internal modulated with 1 Hz PM external)
EUT monitoring:	individual port configuration, EUT monitoring setup and check function, EUT monitoring results displayed during test in both results file and test report
Calibration:	test setup and monitoring probe calibration, display, calibration file store and recall function (limitation of file numbers only by the disk space, typical >340 files)
EUT threshold search:	test interrupt for manual or automatic change of frequency or stress level
Store and recall:	function for test configurations, calibration results and test results (number of files is only limited by the disk space, typical >340 files), supports USB sticks
Component check:	quick system component check, e.g. cable, attenuator max. 52 dB/ 54 dB/ 58 dB attenuation for 20 W/ 30 W/ 75 W amplifier, max. +16 dB gain at 27 dBm output level
Additional features:	free parameter setting from 9 kHz to 1 GHz, external power amplifier support, directional coupler and attenuator

9.4.3. NSG 4070 control software (Windows)

General:	the Windows-based NSG 4070 control software includes all firmware functionality available through the front panel operation, plus the additional features described below. The control software allows the report generator and all post processing features to be used without the remote connection to the NSG 4070.
Remote control:	remote control of NSG 4070 via LAN, USB or RS232
Data transfer:	transfer between NSG 4070 and PC via LAN connection or with USB stick

9.4.4. NSG 4070 control software: Generator mode

Display:	power meter display (units dBm, V, dBµV) with reference value setting, min./max. display and export to a log file (frequency, time, power), EUT monitoring display
Single step mode:	synchronized frequency sweep with power measurement, output as graph and log. file (application: scalar analysis on quadripole networks)

9.4.5. NSG 4070 control software: Immunity mode

Sweep:	test level can be different from calibration value, level sweep with start and stop value or with editable table, level profile editor and sweep function for BCI tests
EUT threshold search:	different options for manual and automatic control
EUT monitoring:	power meter used as EUT monitoring device, test interrupt via keyboard with test report command writing capability (EUT reaction etc.), output control for user port
Additional features:	user port output control for each frequency step or each monitoring event (to control a RF switch for the use of two amplifiers)
One click report generation:	test reports generated in .rtf format, multiple templates available, post processing of measurement data provided (input for test conditions, EUT parameters and comments), editable template structure, user support of repetitive inputs
Export function:	result and calibration files can be converted to .txt files, graphs can be zoomed and converted to .jpg files

9.5. Analog ports

Front panel	
Generator output:	N socket 50 Ω, 9 kHz – 1 GHz
Power amplifier input:	N socket 50 Ω, max. +10 dBm
Power amplifier output:	N socket 50 Ω
Power meter channel 1 to 3:	as defined in chapter “Power meter“
Back panel	
Monitoring input analog:	BNC socket, 0-24 V Ri=15 kΩ, 6 mV resolution
External modulation input:	BNC socket, impedance >10 kΩ, level: 1 Vpp to get 100% AM, 1 Hz – 50 kHz
10 MHz reference output:	BNC socket, approx. 1 Vpp / 50 Ω

9.6. Digital ports

Front panel	
USB	USB host connector for USB stick, keyboard, mouse
Back panel	
User port:	D-Sub 15 pole 4 TTL inputs 4 TTL outputs +12 V / 200 mA, -12 V / 200 mA, +5 V / 200 mA power supply
Monitoring digital input 1:	BNC socket 0-24 V via optical coupler Ri=1.5 kΩ, switching threshold approx. 2-3 V
Monitoring digital input 2:	BNC socket 0-24V via optical coupler, Ri=1.5 kΩ, switching threshold approx. 2-3 V
Monitoring optical input:	LWL (Light wave connector), HP versatile link HFBR0501 series 40 kBd, (avoid scattered light on the back panel)
Trigger input:	BNC socket, TTL for external triggering, max. frequency 100 Hz, trigger delay <10 ms
RS232:	D-Sub 9 pole, up to 115200 Bd
PS2 keyboard:	PS2
USB	USB host connector for USB stick, keyboard, mouse
USB device connector:	for remote control
Network:	RJ45

9.7. Power supply

Power supply unit	110 / 230 VAC 50 / 60 Hz, autoranging	recommended fuse F1 for 110 V	recommended fuse F1 for 230 V
Power consumption without power amplifier:	approx. 80 W	1 A (slow)	0.5 A (slow)
20 W module:	approx. 215 W	4 A (slow)	1.6 A (slow)
30 W module	approx. 240 W	4 A (slow)	1.6 A (slow)
75 W module	approx. 415 W	6.3 A (slow)	2.5 A (slow)

9.8. General data

Operating temperature range:	0°C to 40°C
Storage temperature range:	-20°C to 60°C
Relative humidity:	95% / 30°C (no moisture condensation)
EMC:	DIN/EN 61326-1:2006
Shock:	DIN/EN 60068-2-27
Vibration:	DIN/EN 60068-2-6
Protection class:	DIN/EN 61010-1/IEC 61010-1

9.9. Mechanical specifications

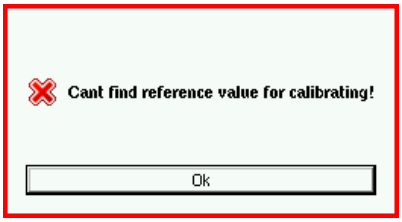
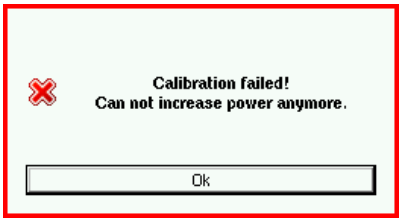
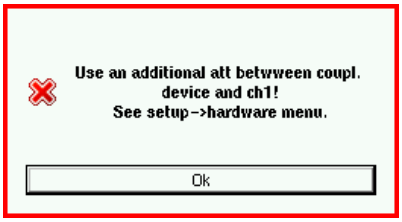
Size (W x H x D) :	45 cm (19“) x 15 cm (3HU) x 42.3 cm (with handle bar and foot)
Weight:	approx. 15 kg (with internal power amplifier), approx. 8 kg (without internal power amplifier)
Size of cardboard box:	80 cm x 61 cm x 34 cm (also for options ATN 60xx and/or LE 4070 additional space available)
Weight of cardboard box:	approx. 8 kg (empty)

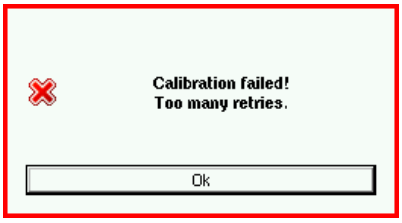
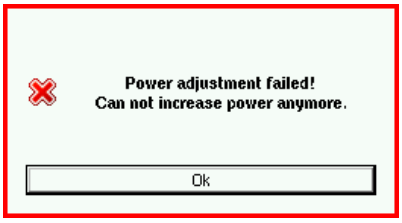
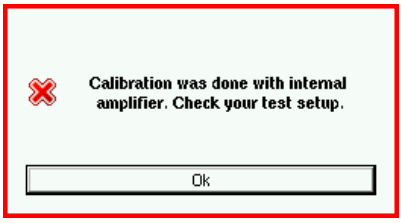
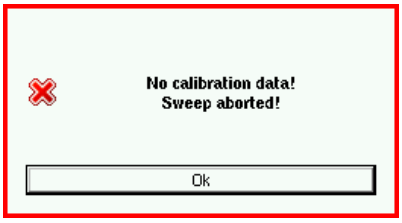
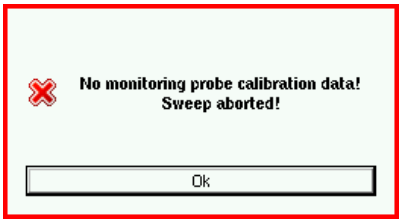
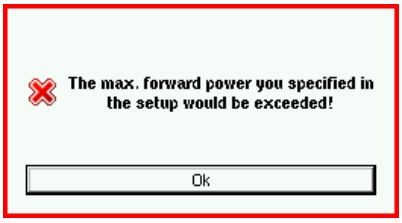
10. TROUBLESHOOTING

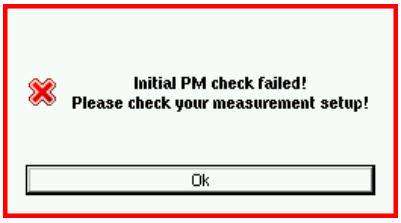
Re-check the unit before beginning troubleshooting

- Are all the connections correct?
- Are you following the instructions in the manual?
- Are the amplifier and connected accessories operating properly?

If the NSG 4070 does not seem to be functioning properly, check the table below. If this does not solve the problem, the NSG 4070 may be damaged. Turn off the power, unplug the power supply cord from the power outlet, and contact your nearest Teseq sales office.

Symptom	Check	Chapter
Power does not turn on.	■ Plug the power supply cord securely into the power outlet. ■ Check if standby LED is on (Orange). ■ Check if the outlet is supplied with power. ■ Check the fuse.	 3.2.1 3.2.2
	Power meter is working below the measuring range. ■ Increase the stress level. ■ Insert an additional attenuator in the path to the coupling device. ■ Reduce the frequency range for calibrating a monitor probe. The insertion loss/amplification might be to high.	 4.5.1.1 8.2.10 4.5.1.4
	Power amplifier limit is reached. ■ Check your setup. ■ Check the connections. ■ Decrease the stress level.	 4.5.1.1
	Power meter ch.1 limit will be exceeded. ■ Insert an additional attenuator in the path to the power meter channel 1 and put this value in the Setup -> hardware menu. ■ Decrease the stress level.	 8.3.5 4.3.4

Symptom	Check	Chapter
	Target level cannot be achieved. ■ Check the connection to channel 2 if using external directional coupler	8.2.10 8.2.11 8.3.5
	Power amplifier is saturated and not able to have the reserve needed for the modulation ■ Check the connections if external amplifier/ directional coupler is used. ■ Use the saturation check ■ Decrease the stress level.	4.5.3.2 4.5.1.1
	■ Use the same amplifier (internal/external) as used for the calibration.	4.5.1.3
	■ First recall calibration file or perform calibration, then start test.	4.5.3.4 4.5.5
	Tests using of the monitoring probe require recall of both the system calibration file and monitor probe calibration file. ■ Recall system calibration file and monitor probe calibration file, then start test.	4.5.3.4 4.5.3.5 4.5.5
	■ Check the specified limitation of the max. forward power. ■ Check the connections ■ Decrease the stress level.	4.3.4 4.5.1.1

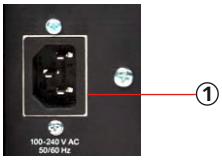
Symptom	Check	Chapter
	■ Check the connection. ■ Insertion loss or amplification of the probe calibration setup is out of range.	9.4.2

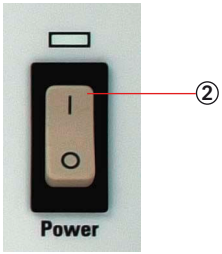
11. EXAMPLES

The following examples show the operation of the NSG 4070. Examples are given for testing IEC/EN 61000-4-6 and Automotive BCI.

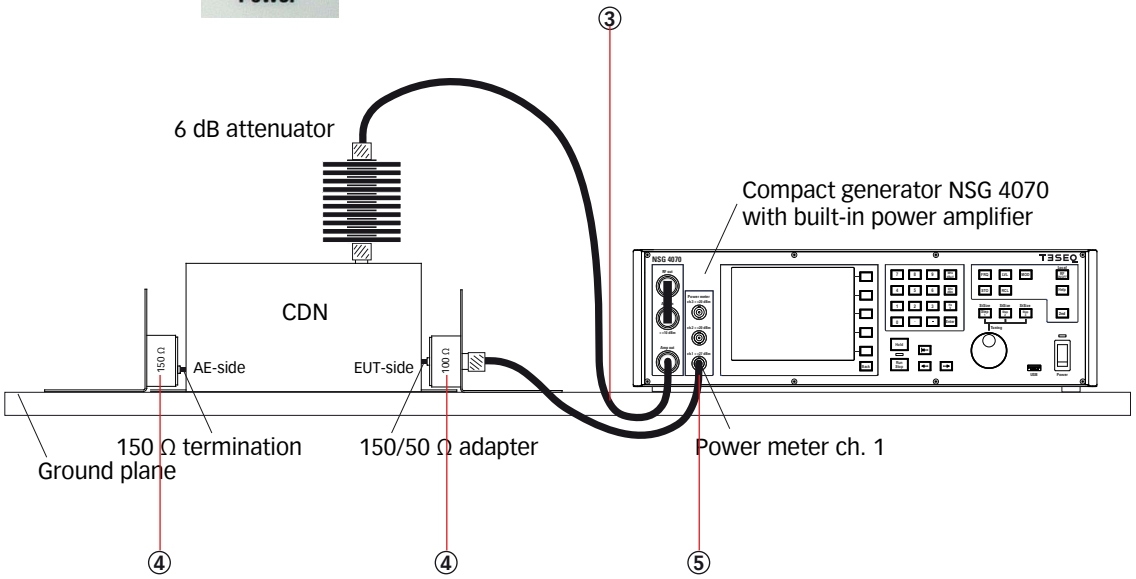
11.1. Example 1: IEC/EN 61000-4-6 testing with CDN

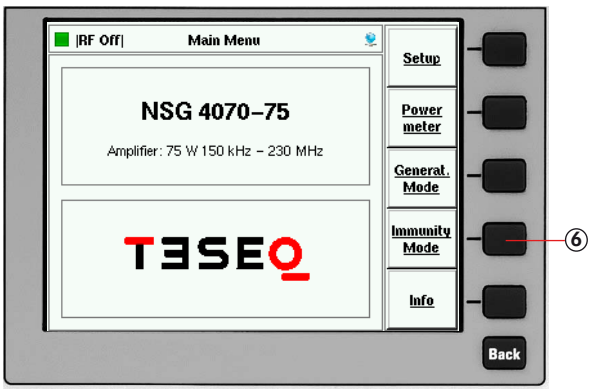
The following example shows the menu-controlled operation of the NSG 4070 for performing tests according to IEC/EN 61000-4-6 with CDNs. This example requires a NSG 4070 with a built-in power amplifier, like the NSG 4070-20, NSG 4070-30 or NSG 4070-75. The CDN must be supplied with calibration adapters for level setting. A 6 dB attenuator and some RF cables are also required.

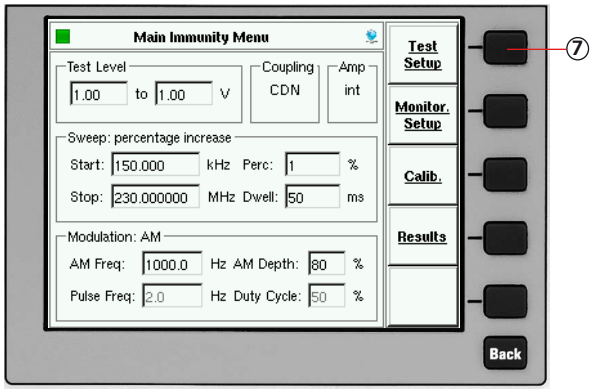


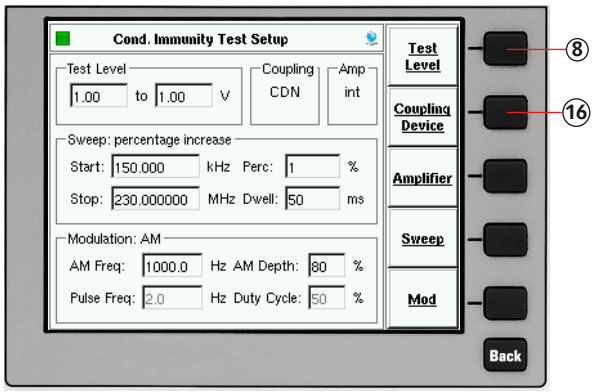


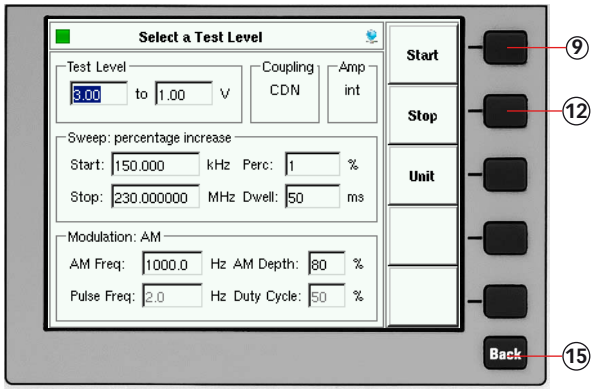
1. Connect the NSG 4070 with a suitable mains socket.
2. Switch the unit on.
3. Connect "AMP out" to the 6 dB attenuator and the CDN.
4. Set up the CDN calibration adapters as shown in the CDN operating instructions.
5. Connect the 150/50 Ω adapter to the power meter channel 1.
6. Press "IMMUNITY MODE".

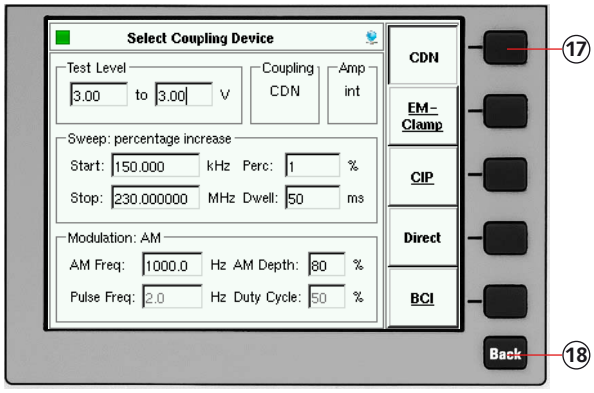


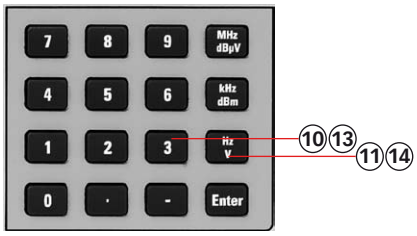




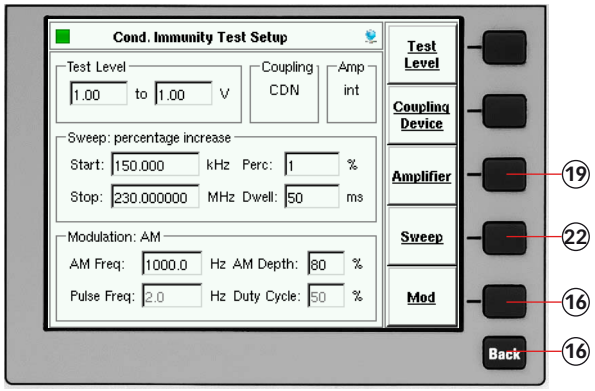


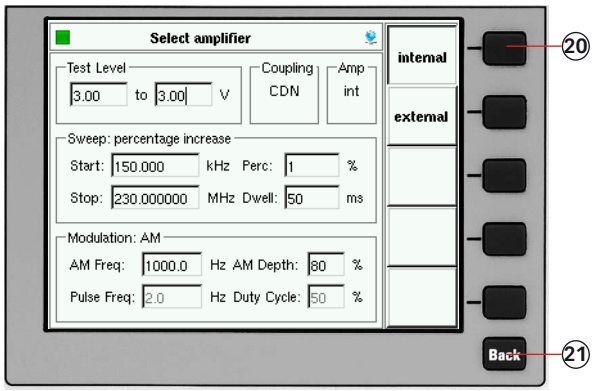


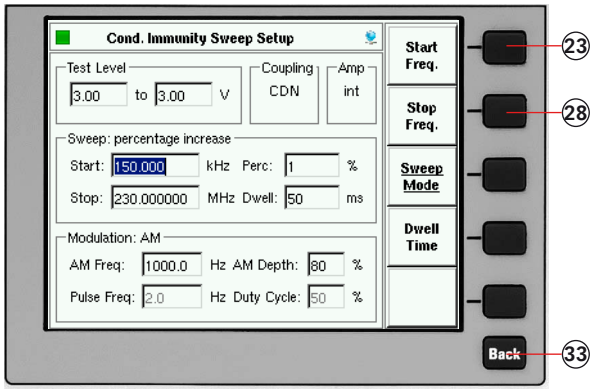


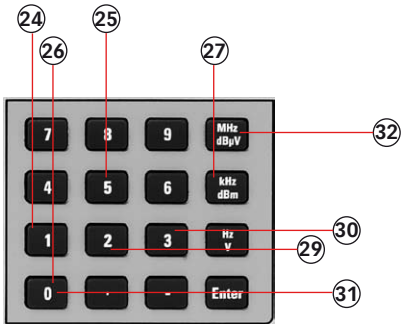


7. Press “TEST SETUP”
8. Press “TEST LEVEL”
9. Press “START”
10. Press “3”
11. Press “V” or “ENTER”
12. Press “STOP”
13. Press “3”
14. Press “V” or “ENTER”
15. Press “BACK”
16. Press “COUPLING DEVICE”
17. Press “CDN”
18. Press “BACK”

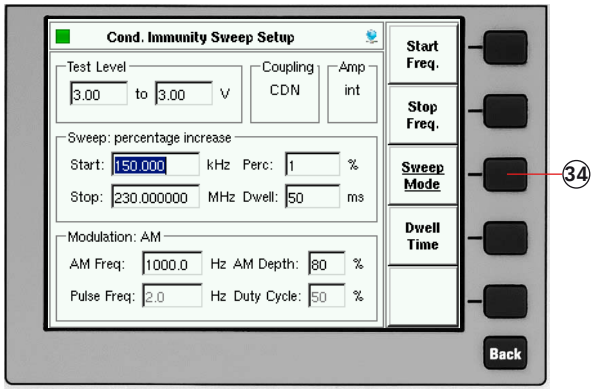




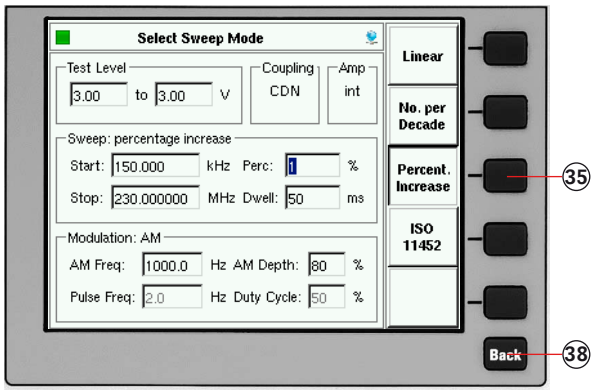


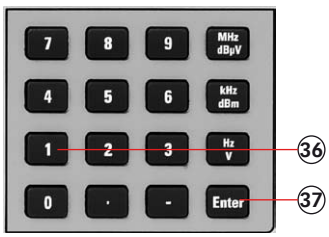


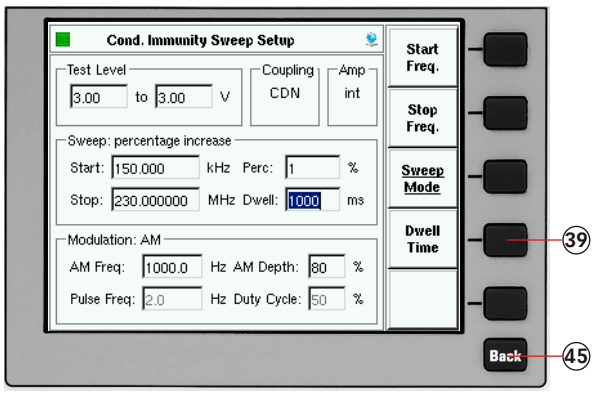
19. Press “AMPLIFIER”
20. Press “INTERNAL”
21. Press “BACK”
22. Press “SWEEP”
23. Press “START FREQ.”
24. Press “1”
25. Press “5”
26. Press “0”
27. Press “kHZ”
28. Press “STOP FREQ.”
29. Press “2”
30. Press “3”
31. Press “0”
32. Press “MHZ”
33. Press “BACK”

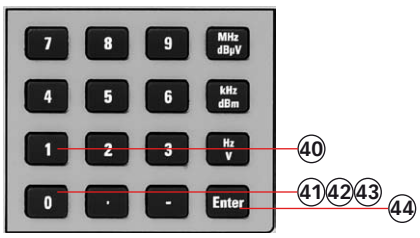


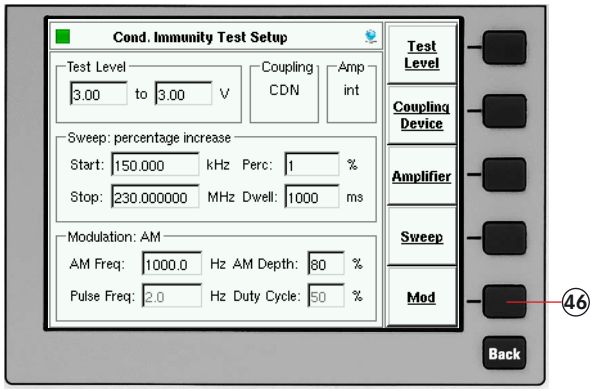
34. Press “SWEEP MODE”
35. Press “PERCENT. INCREASE”
36. Press “1”
37. Press “ENTER”
38. Press “BACK”
39. Press “DWELL TIME”
40. Press “1”
41. Press “0”
42. Press “0”
43. Press “0”
44. Press “ENTER”
45. Press “BACK”



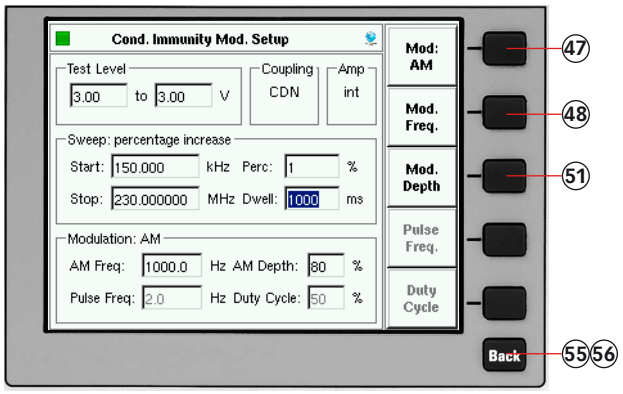


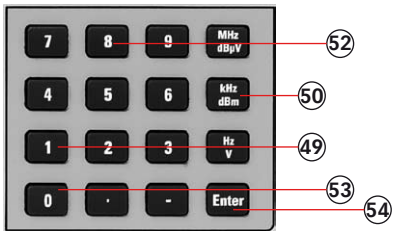




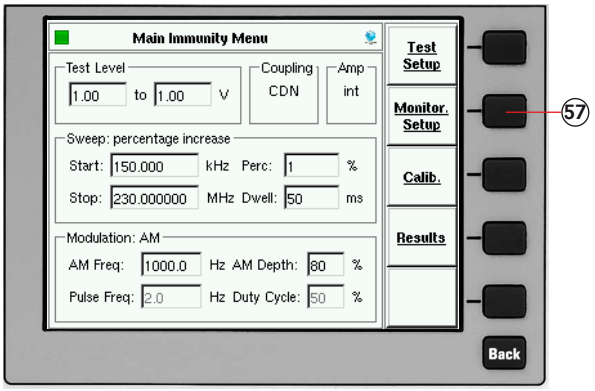


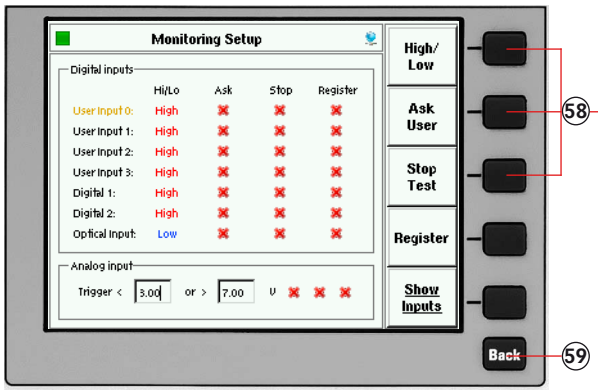
46. Press “MOD.“
47. Press several times to have finally “MOD: AM“ selected.
48. Press “MOD. FREQ“
49. Press “1“
50. Press “kHZ“
51. Press “MOD. DEPTH“
52. Press “8“
53. Press “0“
54. Press “ENTER“
55. Press “BACK“
56. Press “BACK“

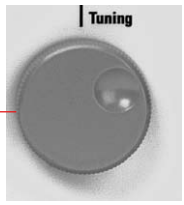


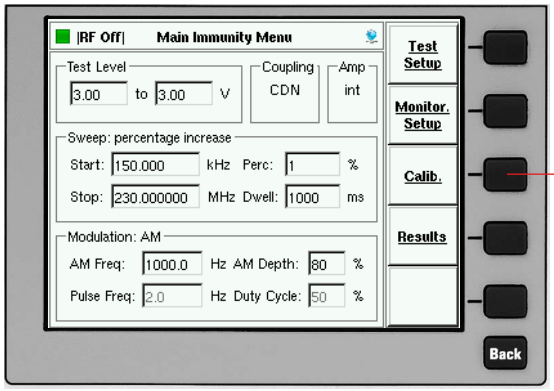


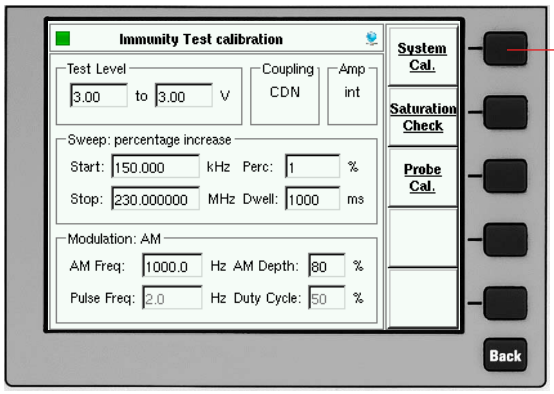
57. Press “MONITOR. SETUP“
58. Switch off all EUT monitoring ports for this example. Turn the knob to change the port and press the required softkey to select “✕“.
59. Press “BACK“

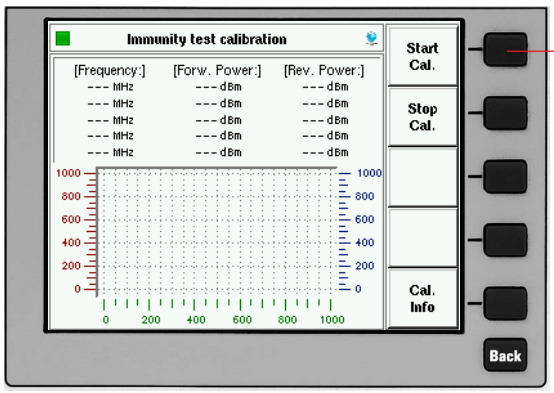


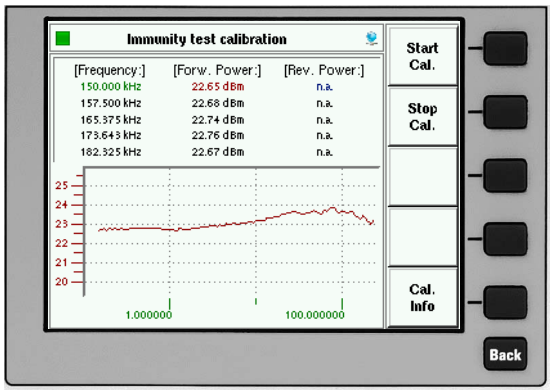




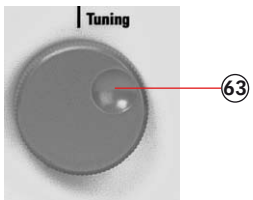








60. Press “CALIB.”
61. Press “SYSTEM CAL.”
62. Press “START CAL” and wait.
63. Turn the knob to check the calibration results. (optional)



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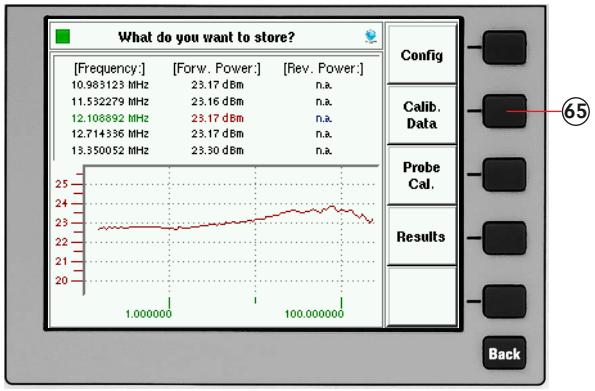
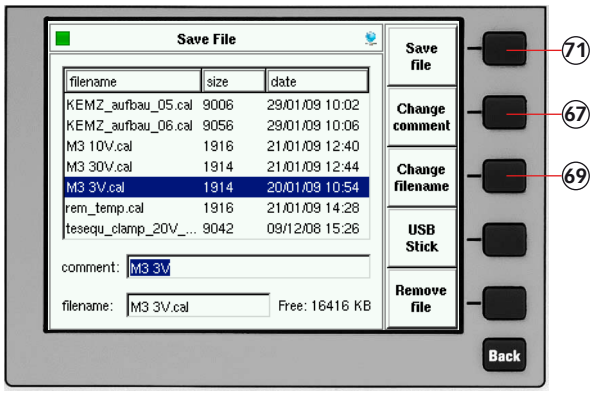
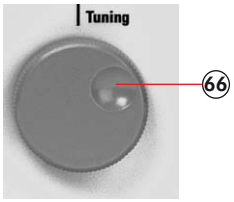
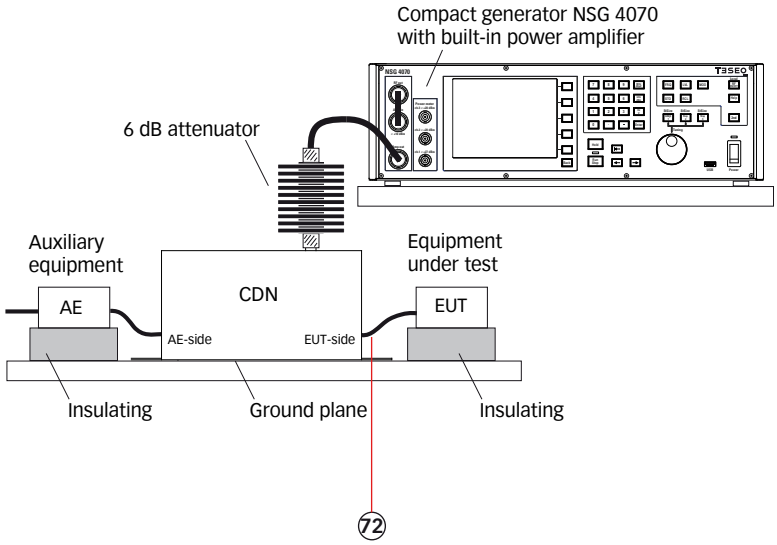
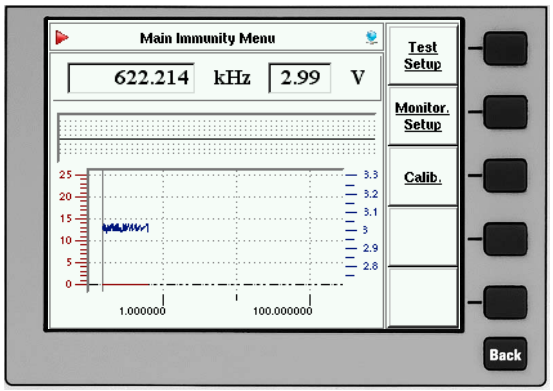




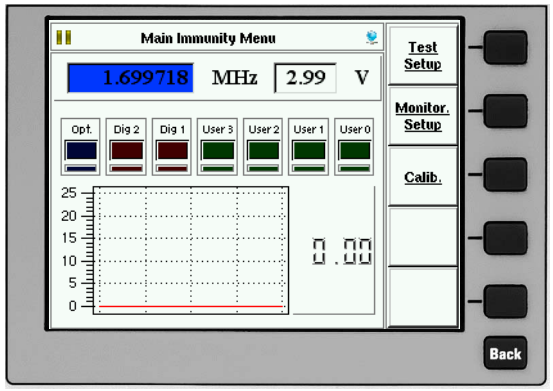
64. Press “STO” to store the calibration file or jump to step 73.
65. Press “CALIB. DATA”
66. Turn the knob to select a similar file comment or name. (optional)
67. Press “CHANGE COMMENT”
68. Type the comment on the connected keyboard.
69. Press “CHANGE FILENAME”
70. Type the name of the file on the connected keyboard.
71. Press “SAVE FILE”
72. Remove the calibration adapters and connect the EUT.

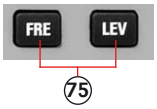


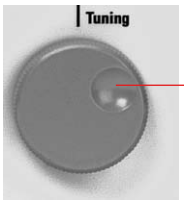


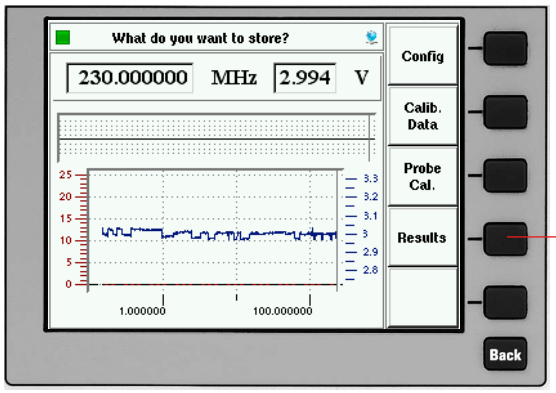


73. Press "RUN" to start the test.
74. Press "HOLD" to interrupt the sweep. (Caution! RF level is still present.)
75. Press "FRE" or "LEV" to select the test frequency or level.
76. Turn the knob to manually change the selected parameter.
77. Press "HOLD" to continue the test.

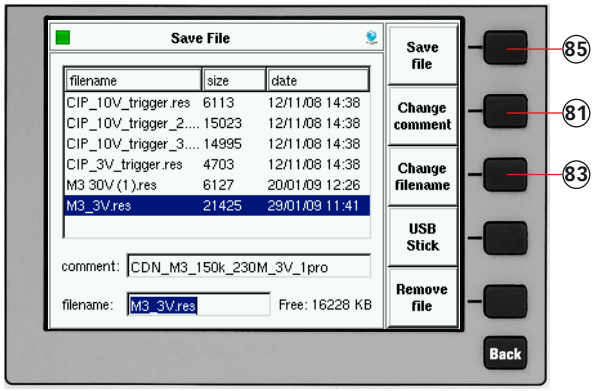


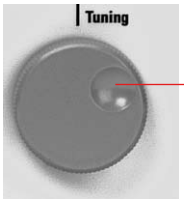






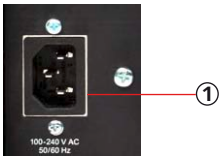
78. Press "STO" to store the result file.
79. Press "RESULTS"
80. Turn the knob to select a similar file comment or name. (optional)
81. Press "CHANGE COMMENT"
82. Type the comment on the connected keyboard.
83. Press "CHANGE FILENAME"
84. Type the name of the file on the connected keyboard.
85. Press "SAVE FILE"

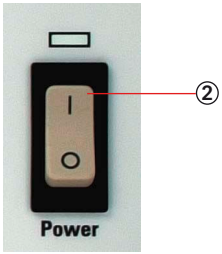




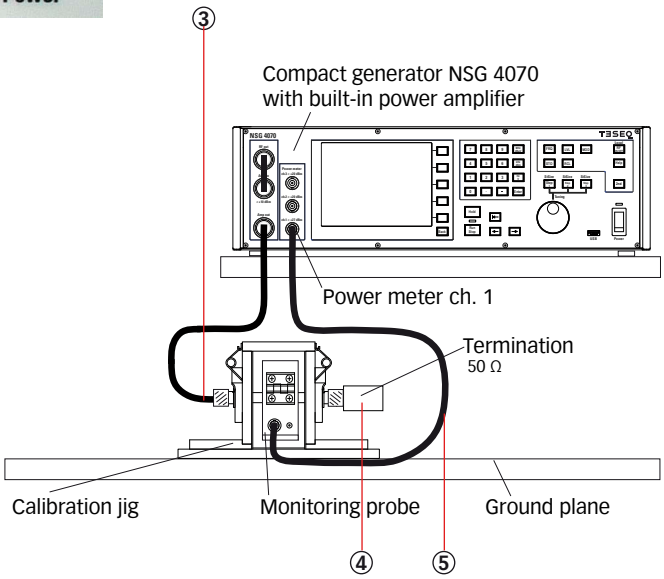
11.2. Example 2: Monitoring probe calibration for IEC/EN 61000-4-6

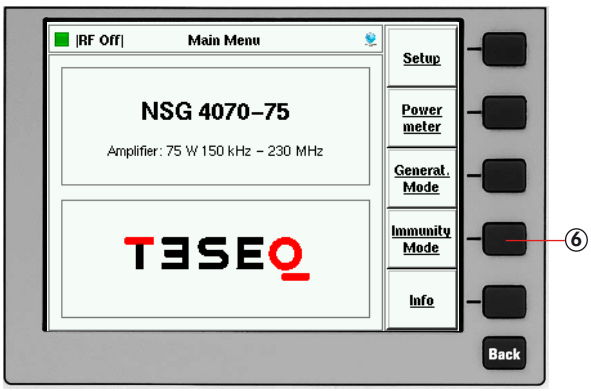
The following example shows the menu-controlled operation of the NSG 4070 for performing the monitoring probe calibration. This example requires a NSG 4070 with a built-in power amplifier, like the NSG 4070-20, NSG 4070-30 or NSG 4070-75. The probe must be inserted in a 50 Ω calibration jig. A termination and some RF cables are also required.

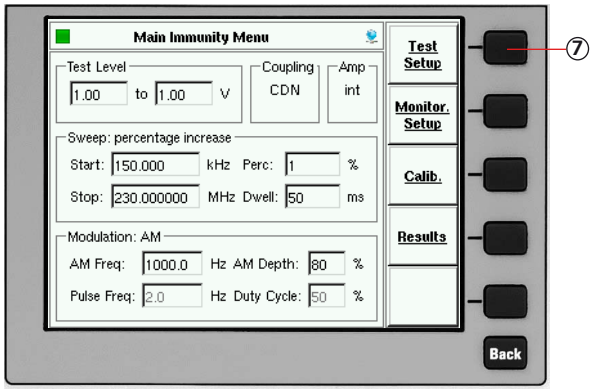


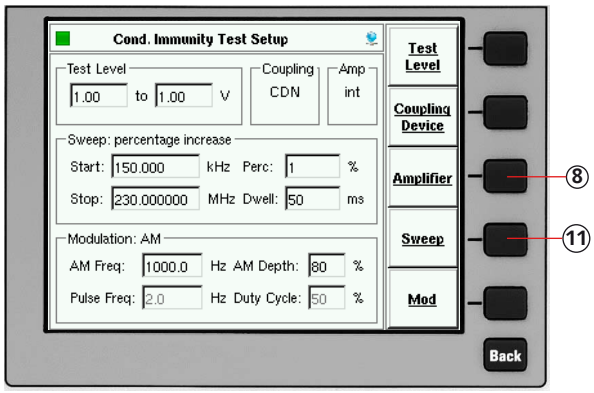


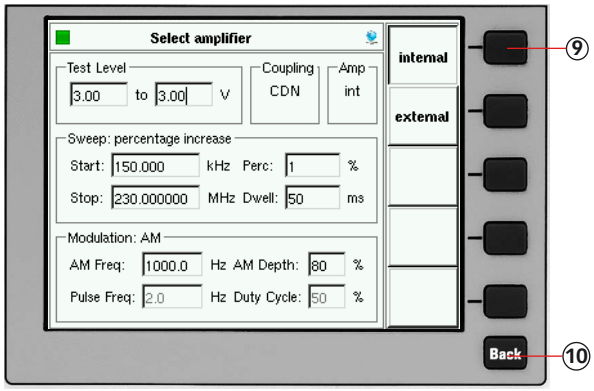
1. Connect the NSG 4070 with a suitable mains socket.
2. Switch the unit on.
3. Connect “AMP out” to the calibration jig.
4. Terminate one side of the calibration jig with 50 Ω.
5. Connect the monitoring probe output to the power meter channel 1.
6. Press “IMMUNITY MODE”.

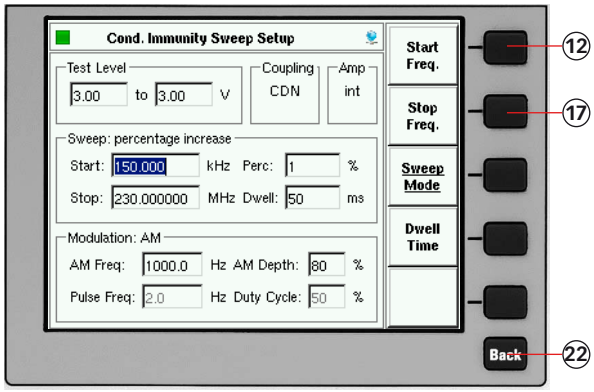


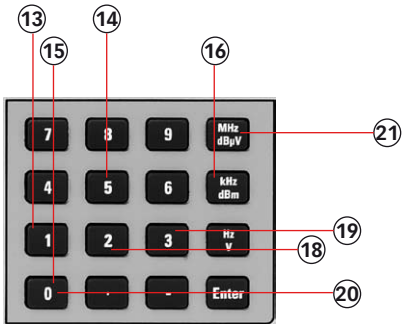




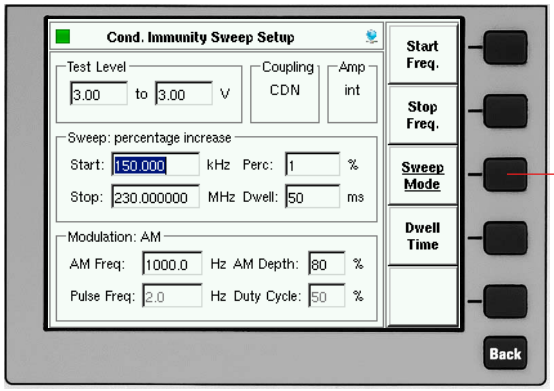


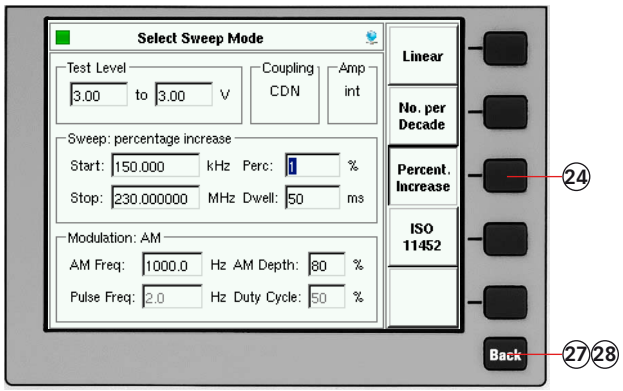


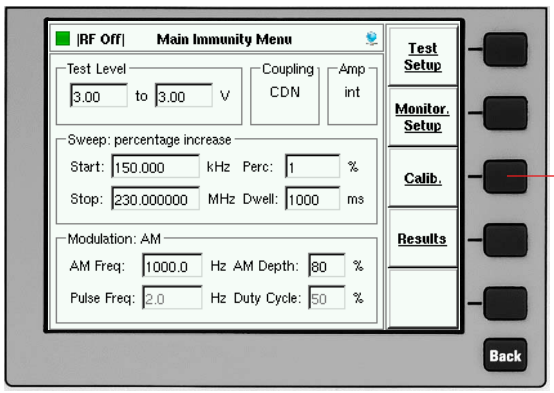


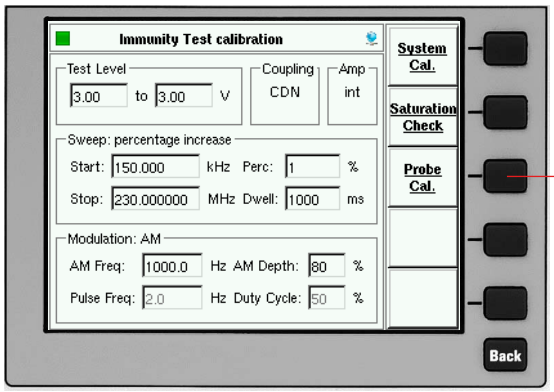


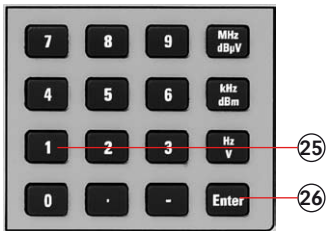
7. Press “TEST SETUP”
8. Press “AMPLIFIER”
9. Press “INTERNAL”
10. Press “BACK”
11. Press “SWEEP”
12. Press “START FREQ.”
13. Press “1”
14. Press “5”
15. Press “0”
16. Press “kHZ”
17. Press “STOP FREQ.”
18. Press “2”
19. Press “3”
20. Press “0”
21. Press “MHZ”
22. Press “BACK”



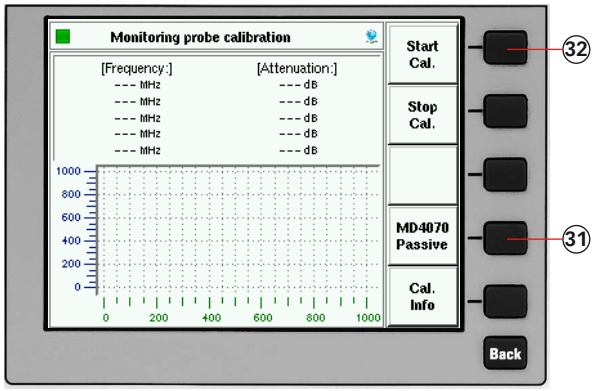




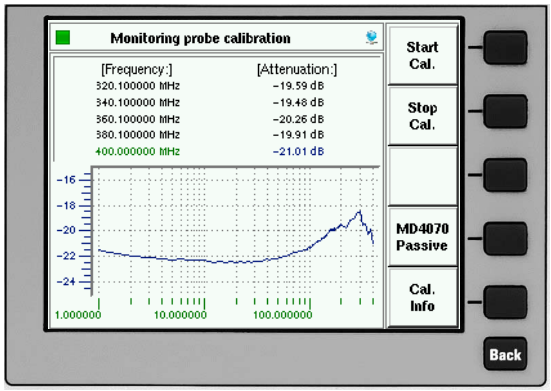


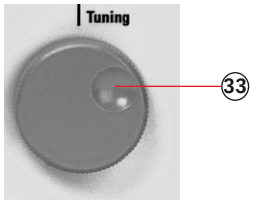


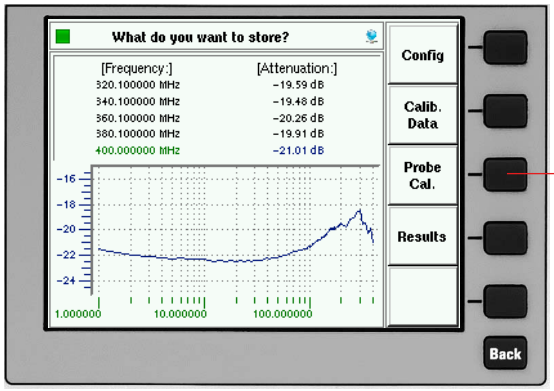
23. Press “SWEEP MODE”
24. Press “PERCENT. INCREASE”
25. Press “1”
26. Press “ENTER”
27. Press “BACK”
28. Press “BACK”
29. Press “CALIB.”
30. Press “PROBE CAL.”



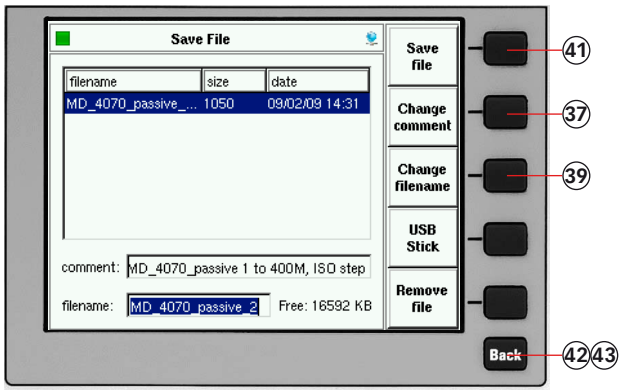
31. Select "MD4070 PASSIVE" if using MD 4070 passive with remote connection. Select "MD4070 ACTIVE" if using MD 4070 active with remote connection.
32. Press "START CAL" and wait.
33. Turn the knob to check the calibration results. (optional)

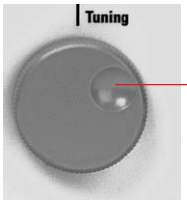






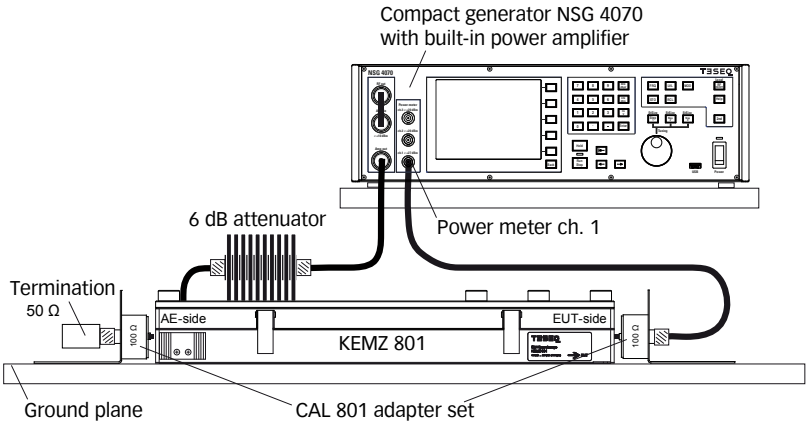
34. Press "STO" to store the calibration file.
35. Press "PROBE CAL."
36. Turn the knob to select a similar file comment or name. (optional)
37. Press "CHANGE COMMENT"
38. Type the comment on the connected keyboard.
39. Press "CHANGE FILENAME"
40. Type the name of the file on the connected keyboard.
41. Press "SAVE FILE"
42. Press "BACK"
43. Press "BACK" (to reach the main menu)



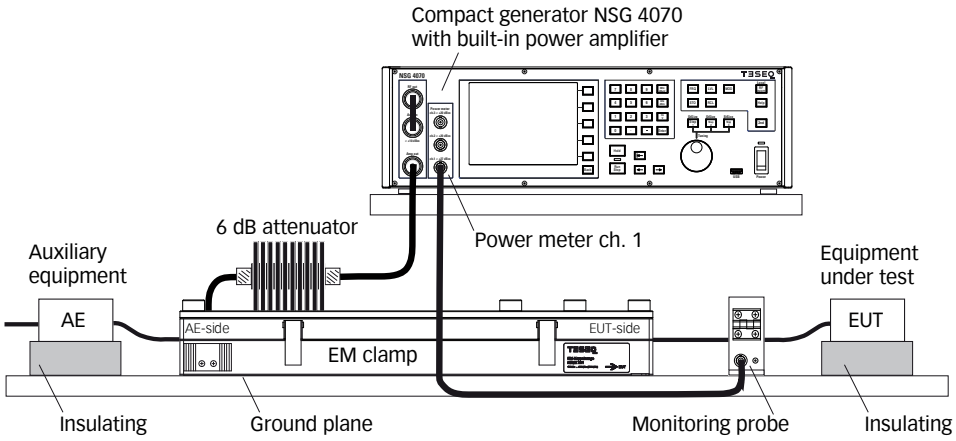


11.3. Example 3: IEC/EN 61000-4-6 testing with EM-clamp and monitoring probe

The following example is based on examples 1 and 2 from Chapter 11.1 and 11.2 - only the differences are shown. This example requires a NSG 4070 with a built-in power amplifier, like the NSG 4070-20, NSG 4070-30 or NSG 4070-75. The EM-clamp and monitoring probe must be supplied with calibration adapters. Further are required. A 6 dB attenuator and some RF cables are also required.

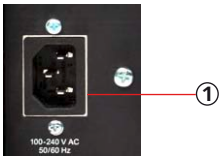


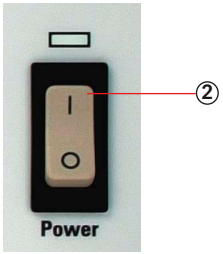
1. Connect the EM-Clamp as shown in the figure above.
2. Follow example 1 steps #1 to #72 with the exception of step #17. Select “EM-CLAMP“ and “WITH PROBE“
3. Follow example 2 steps #29 to #43.
4. Connect the EM-Clamp and monitoring probe as shown in the figure below.
5. Start the test as shown in example 1 steps #73 to #84. (Please note any test with a coupling device and monitoring probe needs must have calibration files loaded for each unit.)



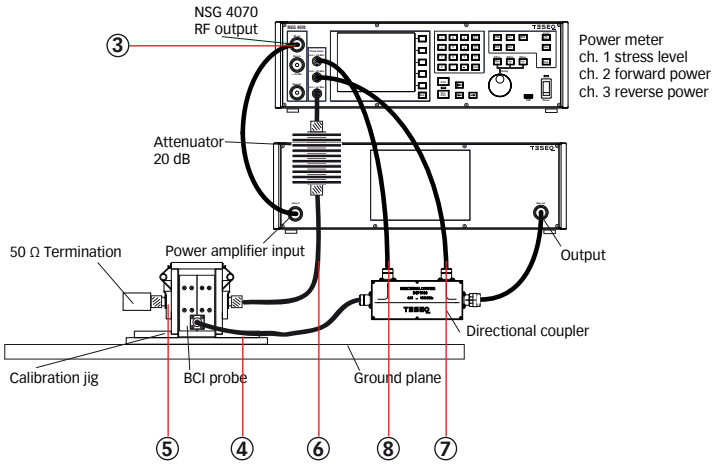
11.4. Example 4: BCI testing

The following example shows the menu-controlled operation of the NSG 4070 for performing tests according ISO 11452-4. This example requires a NSG 4070, external directional coupler, external power amplifier, BCI probe and calibration jig. A termination for the calibration jig and an attenuator to protect the power meter are also required.

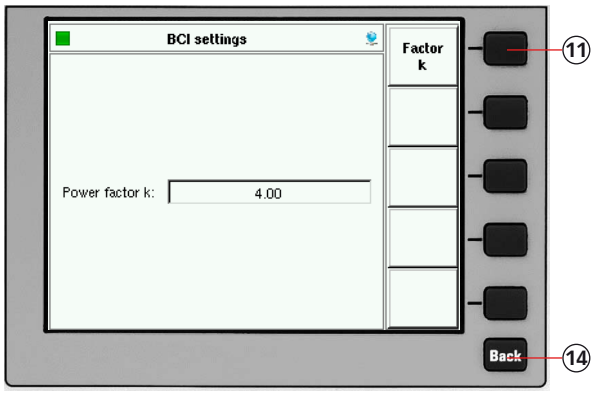


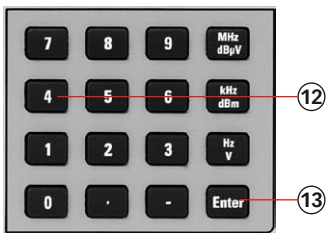


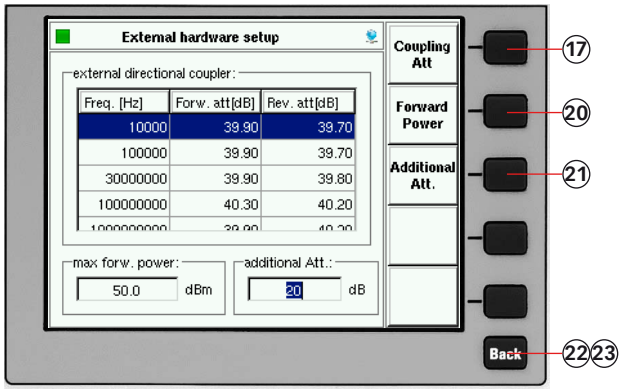
1. Connect the NSG 4070 with a suitable mains socket.
2. Switch the unit on.
3. Connect “RF out“ to the power amplifier input.
4. Connect the output of the power amplifier to the BCI probe via the directional coupler.
5. Set up the calibration jig and termination as shown in the figure below.
6. Connect one side of the calibration jig to the power meter channel 1.
7. Connect the directional coupler out to the power meter channel 2 to measure the forward power.
8. Connect the directional coupler out to the power meter channel 3 to measure the reverse power.
9. Press “SETUP“.



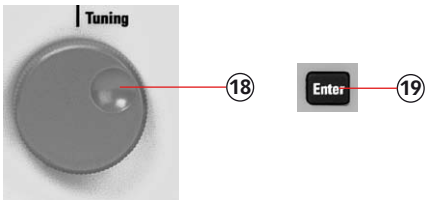
10. Press “BCI SETTINGS” (only needed for Closed Loop method)
11. Press “FACTOR K”
12. Press “4”
13. Press “ENTER”
14. Press “BACK”
15. Press “HARDWARE”

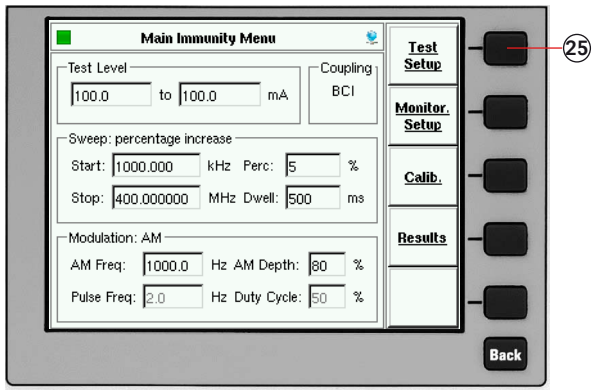


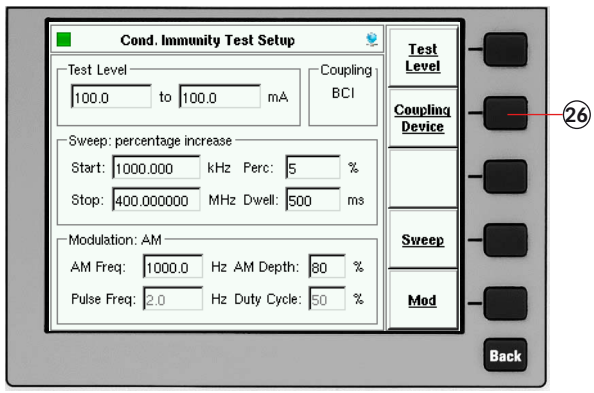


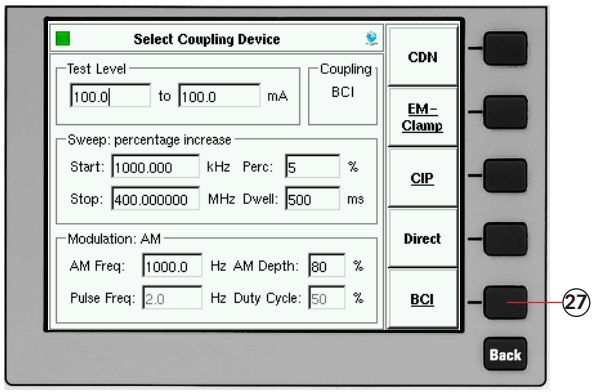


16. Insert the USB stick with the correction factors of the directional coupler and wait few seconds.
17. Press “COUPLING ATT.”
18. Turn the knob to select the file.
19. Press “ENTER”
20. Press “FORWARD POWER” and change this limit as required by the hardware.
21. Press “ADDITIONAL ATT.” and change this value in case an attenuator is used to protect power meter channel 1 (recommended for tests with 100 mA).
22. Press “BACK”
23. Press “BACK”

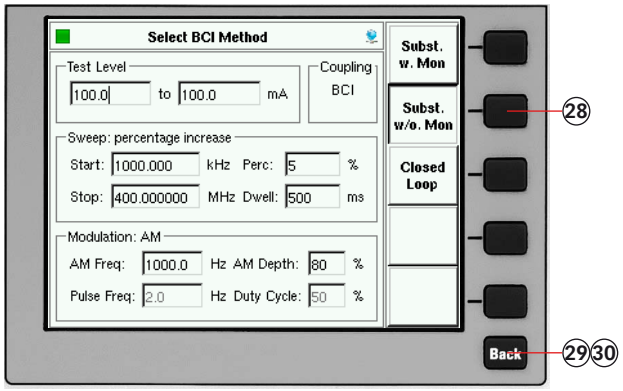


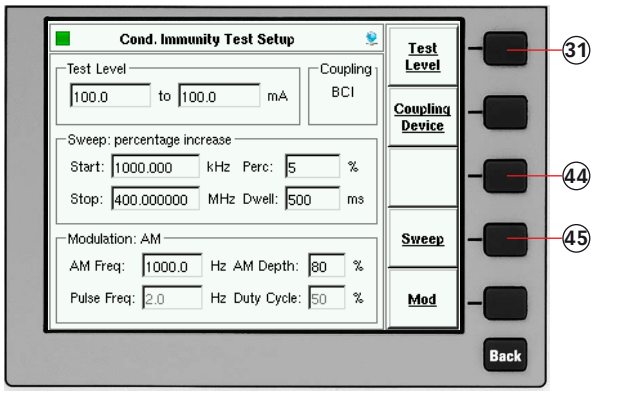


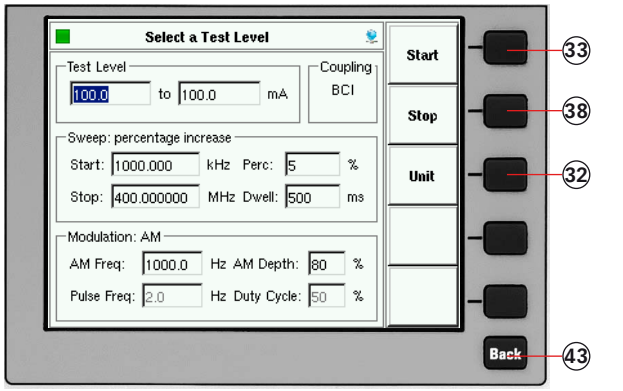


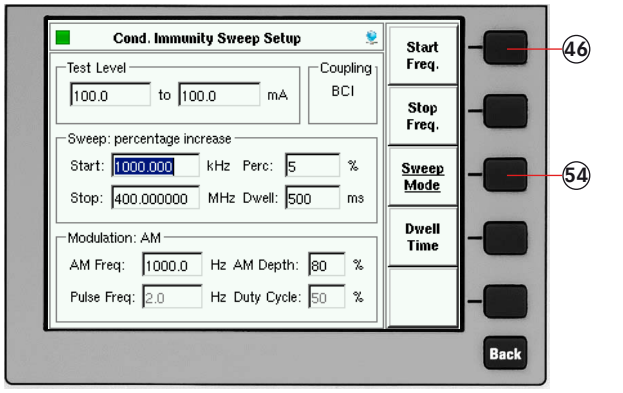


24. Press “IMMUNITY MODE”
25. Press “TEST SETUP”
26. Press “COUPLING DEVICE”
27. Press “BCI”

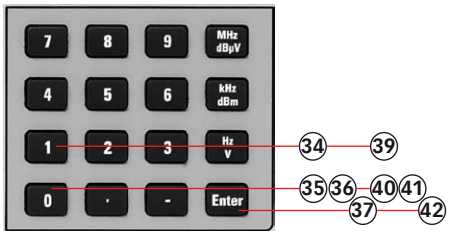




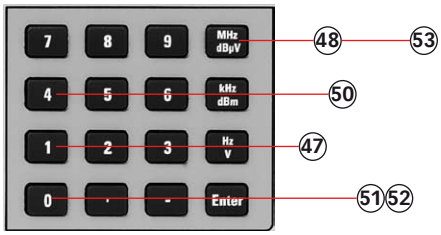


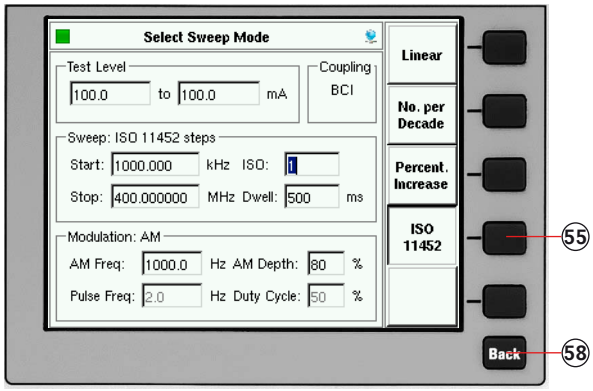


28. Press “SUBST. W/O MON.” to test without monitoring probe.
29. Press “BACK”
30. Press “BACK”
31. Press “Test level”
32. Press “UNIT” to change from [dBµA] to [mA].
33. Press “START”
34. Press “1”
35. Press “0”
36. Press “0”
37. Press “ENTER”
38. Press “STOP”
39. Press “1”
40. Press “0”
41. Press “0”
42. Press “ENTER”
43. Press “BACK”
44. Press “AMPLIFIER” and select “EXTERNAL” only for NSG 4070 with internal power amplifier and use of the external amplifier.
45. Press “SWEEP”

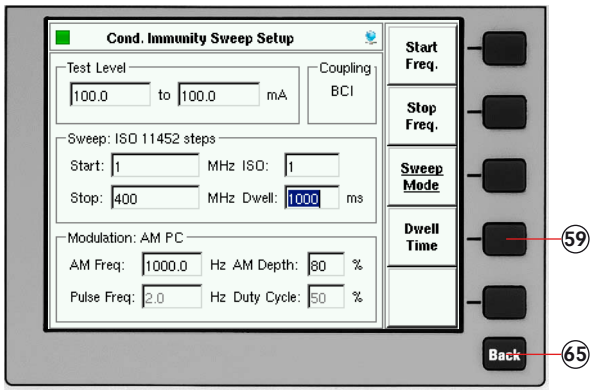


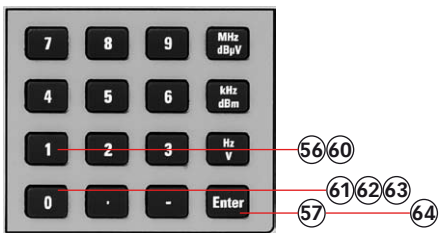
46. Press “START FREQ.”
47. Press “1”
48. Press “MHZ”
49. Press “STOP FREQ.”
50. Press “4”
51. Press “0”
52. Press “0”
53. Press “MHZ”
54. Press “SWEEP MODE”

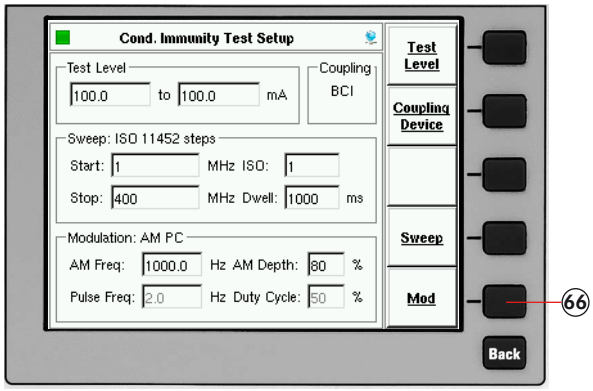




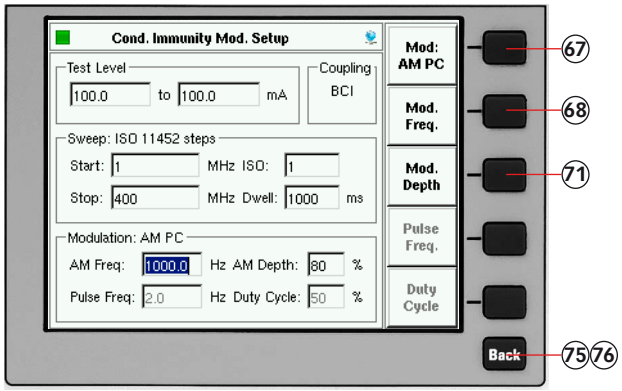
55. Press “ISO 11452”
56. Press “1”
57. Press “ENTER”
58. Press “BACK”
59. Press “DWELL TIME”
60. Press “1”
61. Press “0”
62. Press “0”
63. Press “0”
64. Press “ENTER”
65. Press “BACK”

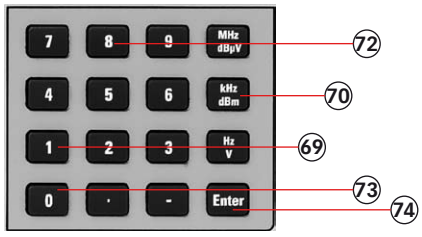


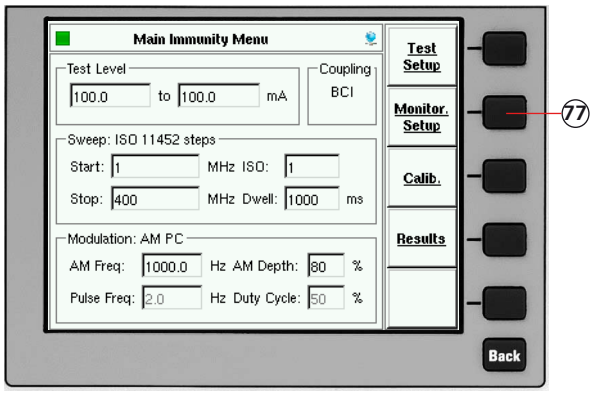




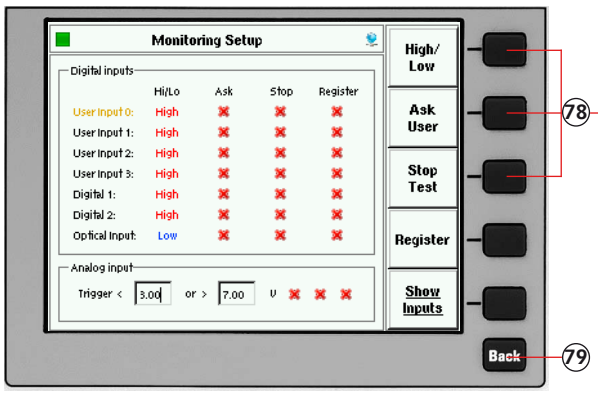
66. Press “MOD.”
67. Press several times to have finally “MOD: AM PC” selected.
68. Press “MOD. FREQ”
69. Press “1”
70. Press “kHZ”
71. Press “MOD. DEPTH”
72. Press “8”
73. Press “0”
74. Press “ENTER”
75. Press “BACK”
76. Press “BACK”

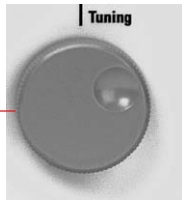




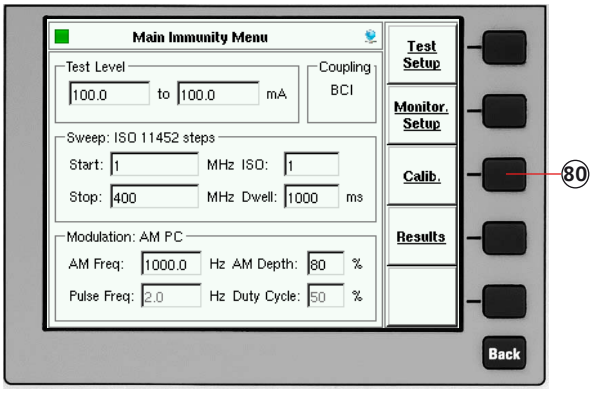


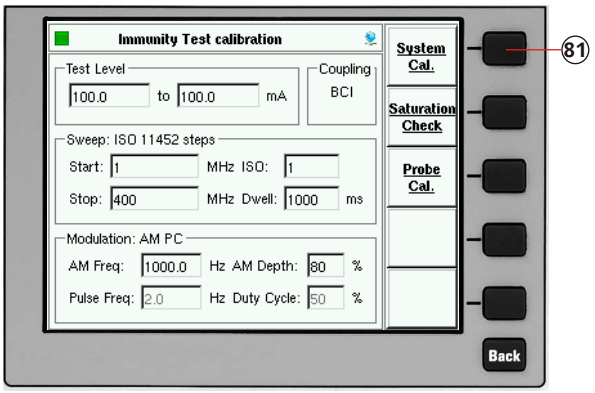
77. Press “MONITOR. SETUP”
78. Switch off all EUT monitoring ports for this example. Turn the knob to change the port and press the required softkey to select “✕”.
79. Press “BACK”

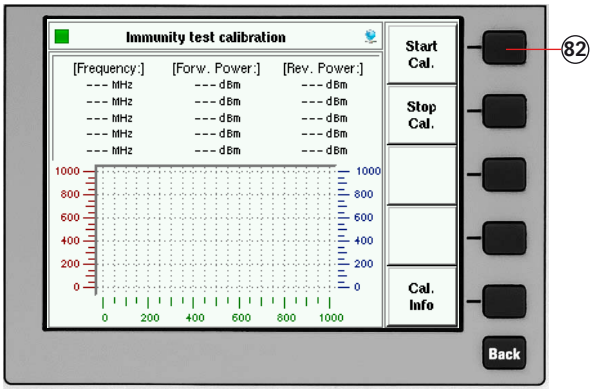




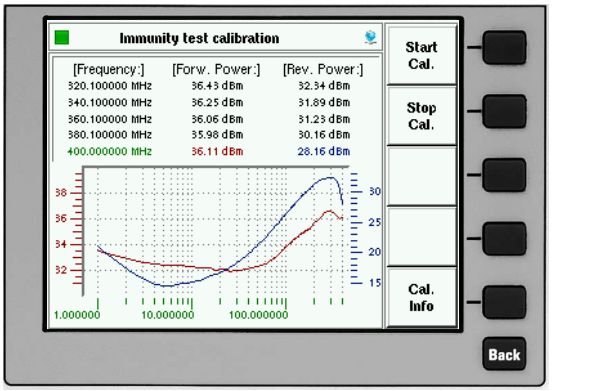
80. Press “CALIB.”
81. Press “SYSTEM CAL.”

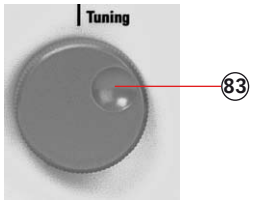


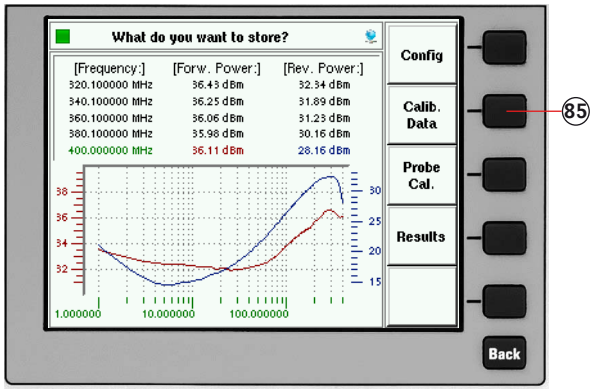




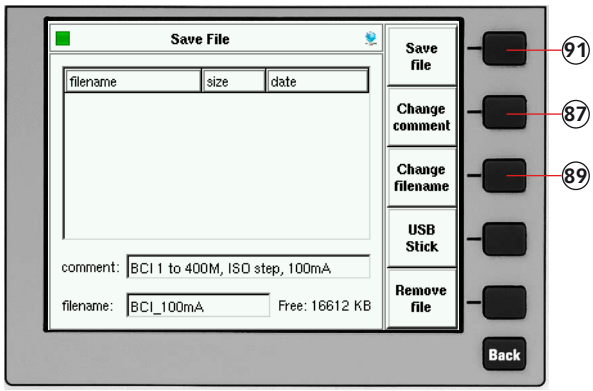
82. Press “START CAL.” and wait.
83. Turn the knob to check the calibration results. (optional)

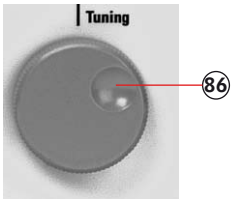


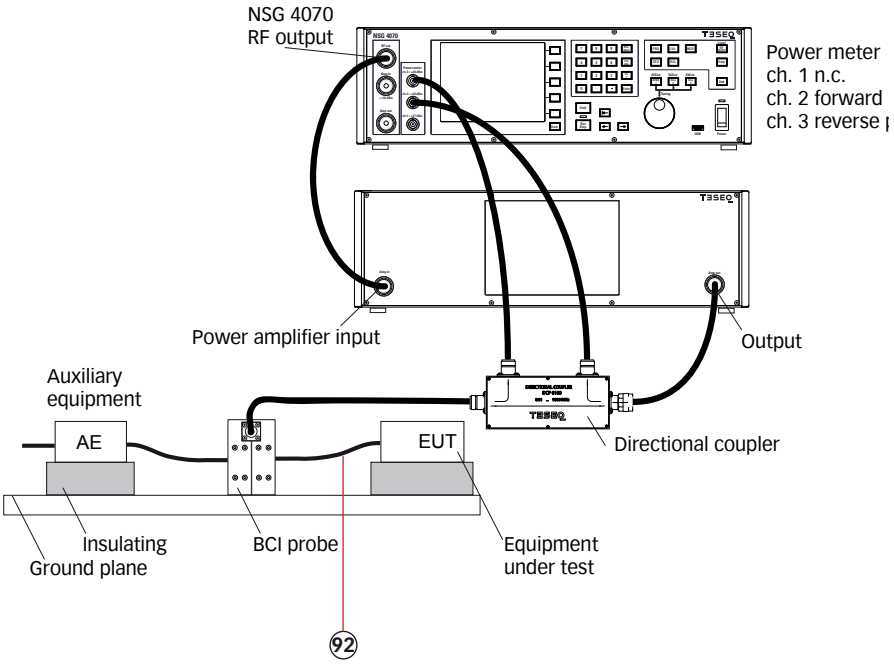


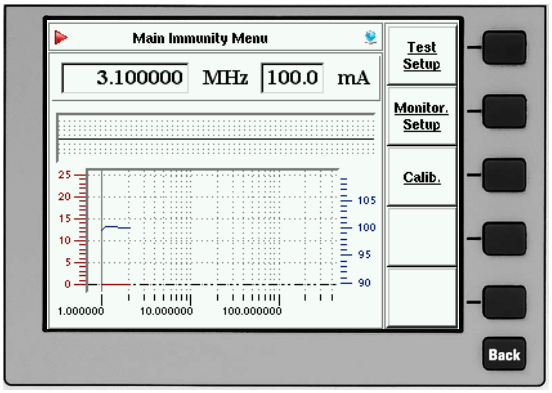


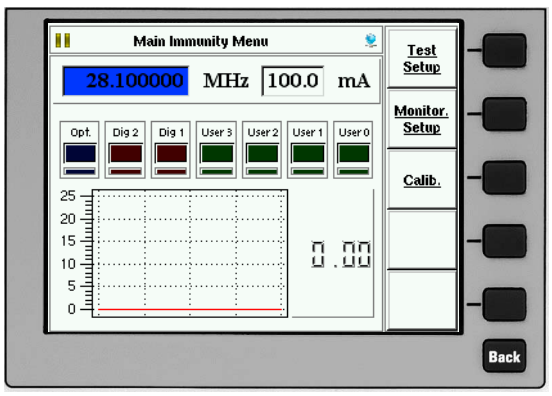
84. Press “STO” to store the calibration file or jump to step 93.
85. Press “CALIB. DATA”
86. Turn the knob to select a similar file comment or name. (optional)
87. Press “CHANGE COMMENT”
88. Type in the comment with the connected keyboard.
89. Press “CHANGE FILENAME”
90. Type in the name of the file with the connected keyboard.
91. Press “SAVE FILE”



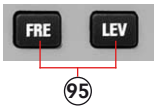


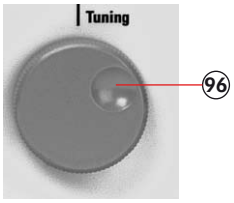


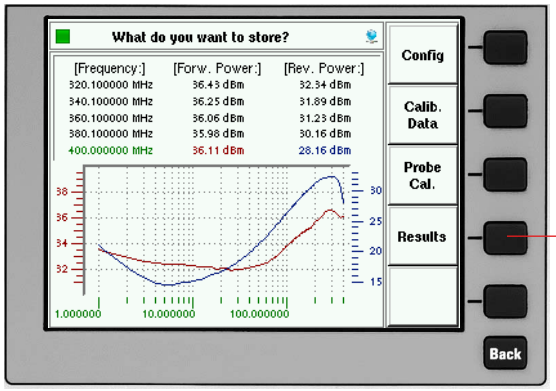


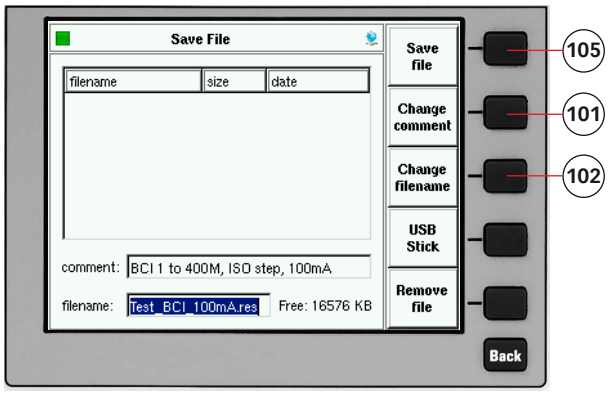


92. Remove the calibration jig and connect the EUT.
93. Press "RUN" to start the test.
94. Press "HOLD" to interrupt the sweep. (Caution! RF level is still present.)
95. Press "FRE" or "LEV" to select the test frequency or level.
96. Turn the knob to manually change the selected parameter.
97. Press "HOLD" to continue the test.

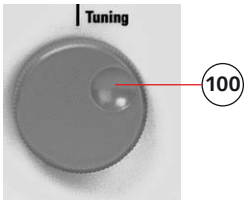






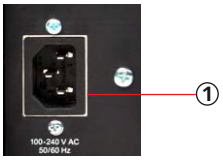


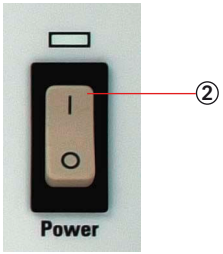
98. Press “STO“ to store the result file.
99. Press “RESULTS“
100. Turn the knob to select a similar file comment or name. (optional)
101. Press “CHANGE COMMENT“
102. Type in the comment with the connected keyboard.
103. Press “CHANGE FILENAME“
104. Type in the name of the file with the connected keyboard.
105. Press “SAVE FILE“



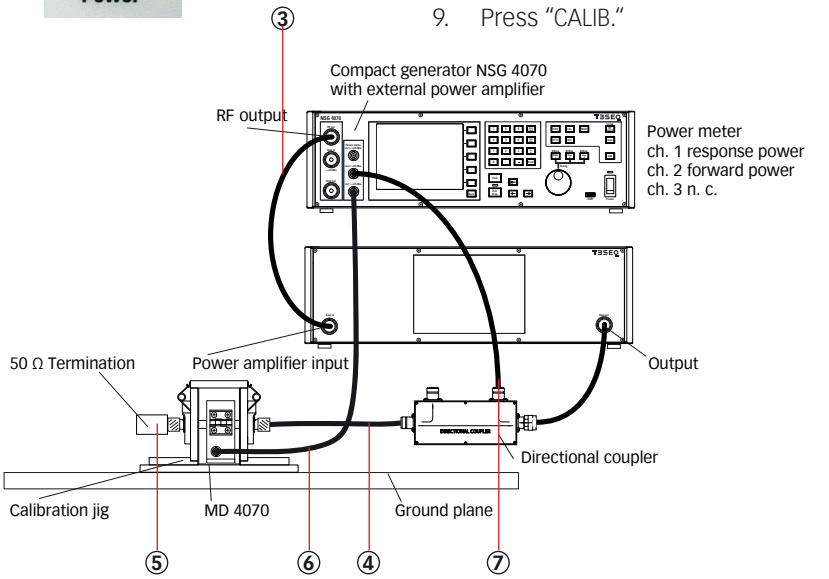
11.5. Example 5: Monitoring probe calibration for BCI

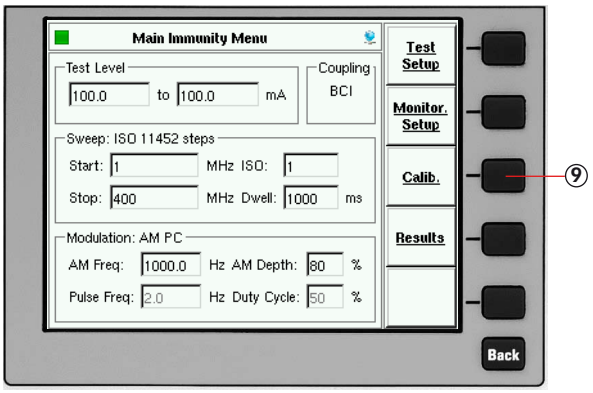
The following example shows the menu-controlled operation of the NSG 4070 for performing the monitoring probe calibration. This example requires a NSG 4070, external directional coupler, external power amplifier, monitoring probe and calibration jig. A termination for the calibration jig is also required. The probe must be inserted in a 50 Ω calibration jig.

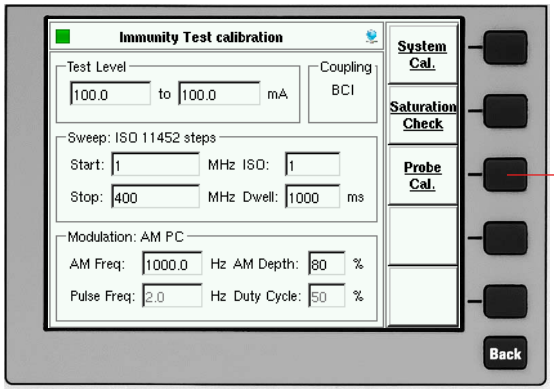


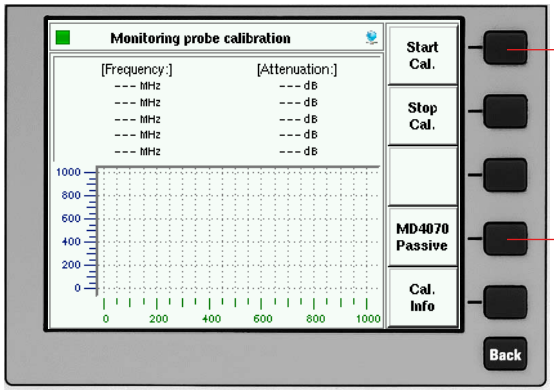


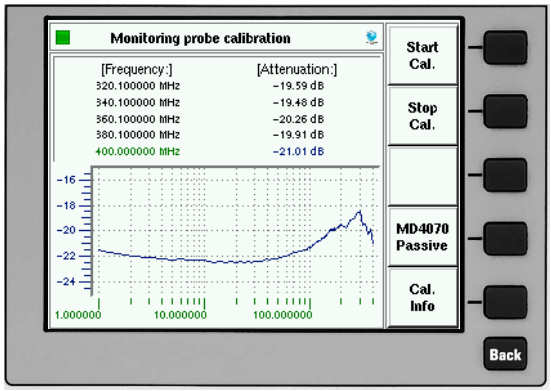
1. Connect the NSG 4070 with a suitable mains socket.
2. Switch the unit on.
3. Connect "RF out" to the power amplifier input.
4. Connect the output of the power amplifier via the directional coupler to the calibration jig.
5. Terminate the calibration jig as shown in the figure below.
6. Connect the RF output of the probe to the power meter channel 1.
7. Connect the directional coupler out to the power meter channel 2 to measure the forward power.
8. Follow example 4 steps #9 to #58 and press 2 x "BACK" (to reach the "MAIN IMMUNITY MENU").
9. Press "CALIB."

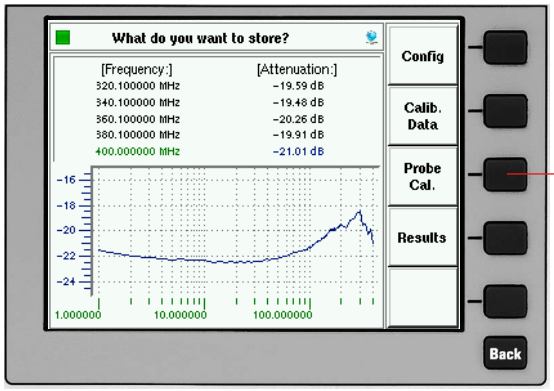




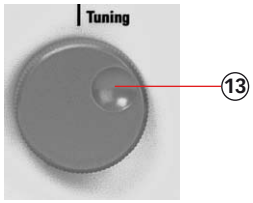






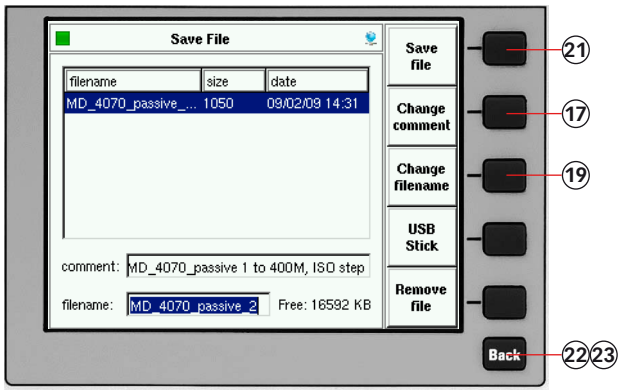


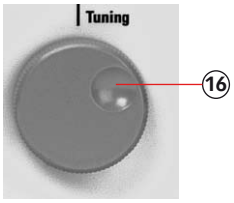
10. Press "PROBE CAL."
11. Select "MD4070 PASSIVE" if using MD 4070 passive with remote connection. Select "MD4070 ACTIVE" if using MD 4070 active with remote connection.
12. Press "START CAL." and wait.
13. Turn the knob to check the calibration results. (optional)
14. Press "STO" to store the calibration



file.

15. Press "PROBE CAL."
16. Turn the knob to select a similar file

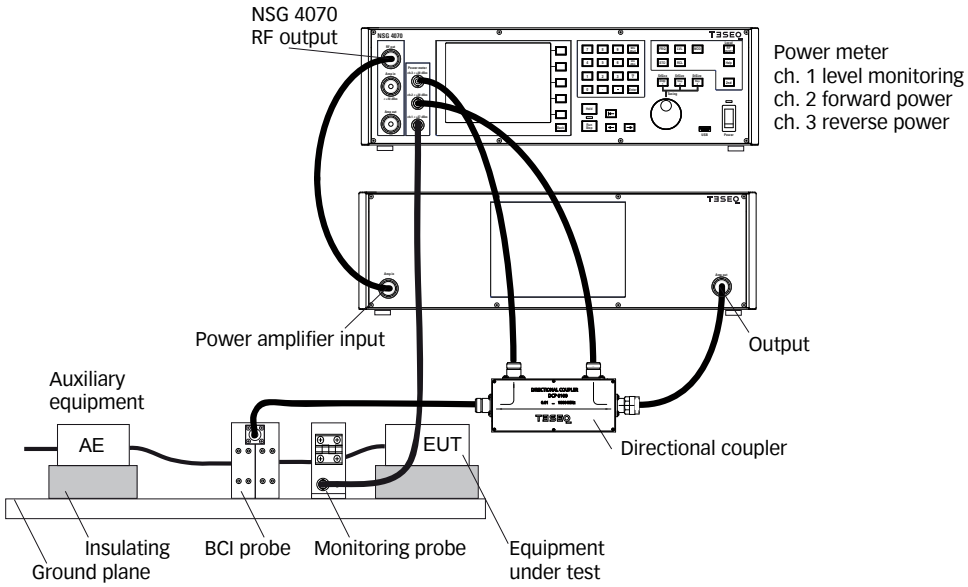




comment or name. (optional)
17. Press "CHANGE COMMENT"
18. Type the comment on the connected keyboard.
19. Press "CHANGE FILENAME"
20. Type the name of the file on the connected keyboard.
21. Press "SAVE FILE"
22. Press "BACK"
23. Press "BACK" (to reach the main menu)

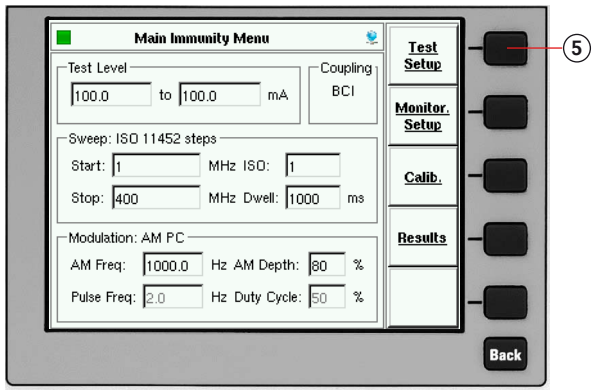
11.6. Example 6: BCI testing with monitoring probe

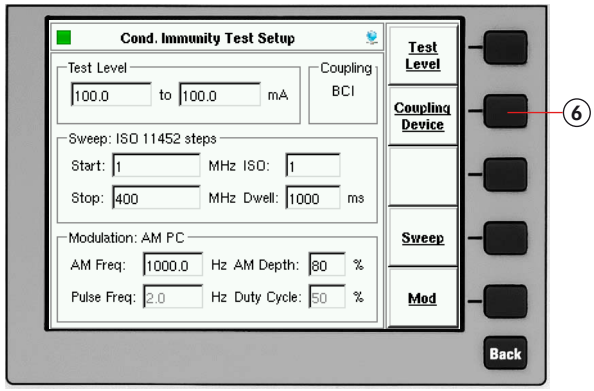
The following example is based on examples 4 and 5 (chapter 11.4 and 11.5). This example requiresa NSG 4070, external directional coupler, external power amplifier, BCI probe and monitoring probe.

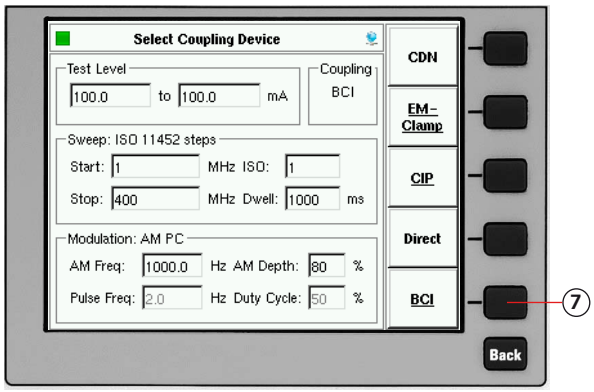


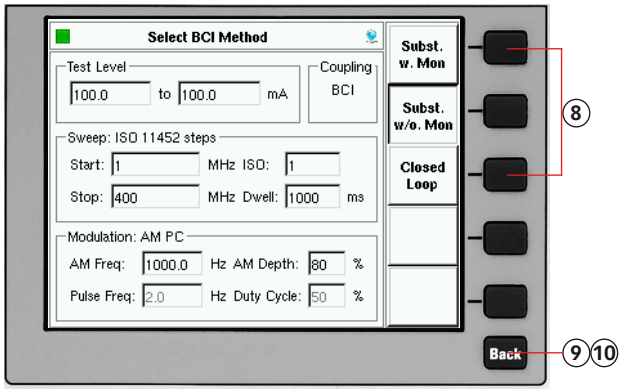
1. Connect the BCI probe and monitoring probe as shown in the figure above.
2. Follow example 4 steps #1 to #91 and press 2 x "BACK" (to reach the "MAIN IMMUNITY MENU")
3. Follow example 5 steps #1 to #23 and press "BACK" (to reach the "MAIN MENU" for this example)

4. Press “IMMUNITY MODE”
5. Press “TEST SETUP”
6. Press “COUPLING DEVICE”
7. Press “BCI”

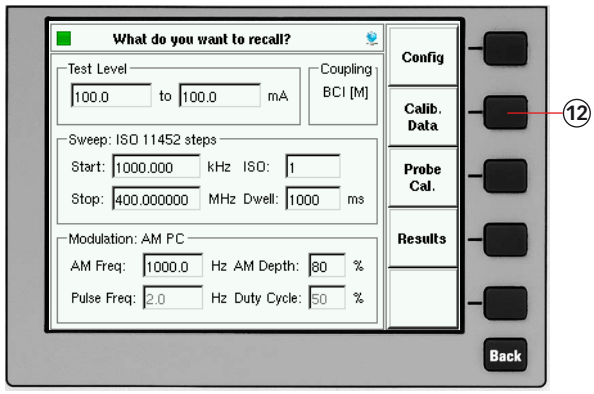




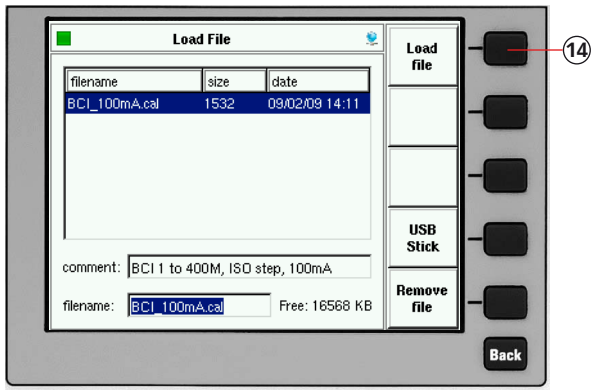


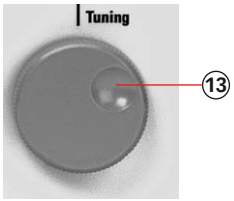


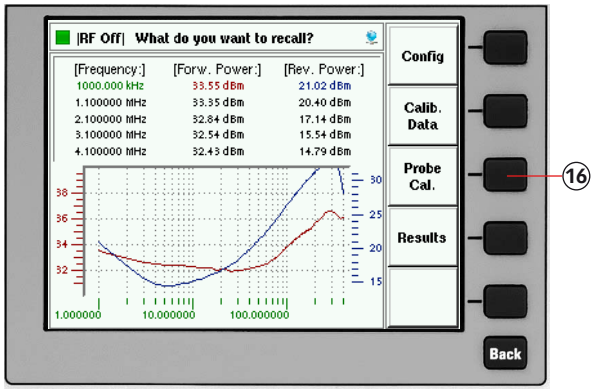
8. Press "SUBST. W MON." or "CLOSED LOOP" to test with monitoring probe.
9. Press "BACK"
10. Press "BACK"



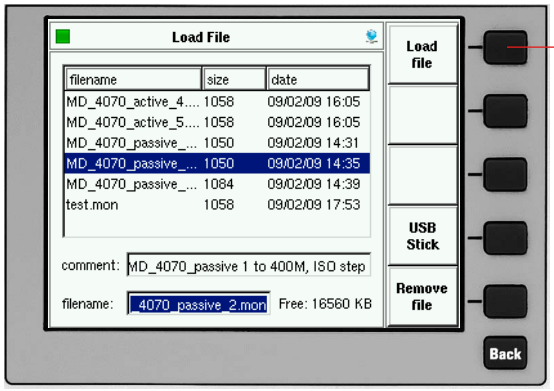
11. Press "RCL" to recall the system calibration file (optional if calibrated just before, jump to step #15).
12. Press "CALIB. DATA"
13. Turn the knob to select the file.
14. Press "LOAD FILE"

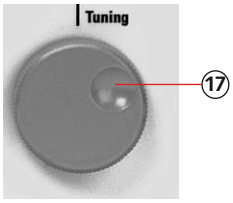




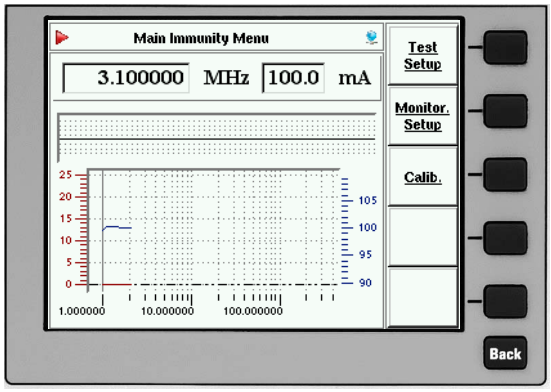


15. Press "RCL" to recall the probe calibration file (optional if calibrated just before, jump to step #19).
16. Press "PROBE CAL."

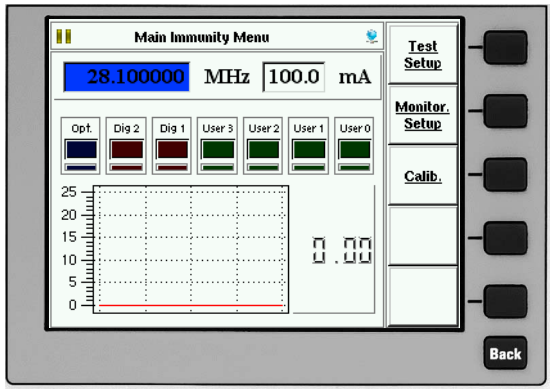


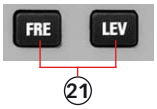


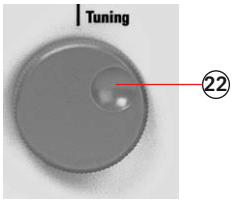
17. Turn the knob to select the file.
18. Press “LOAD FILE“

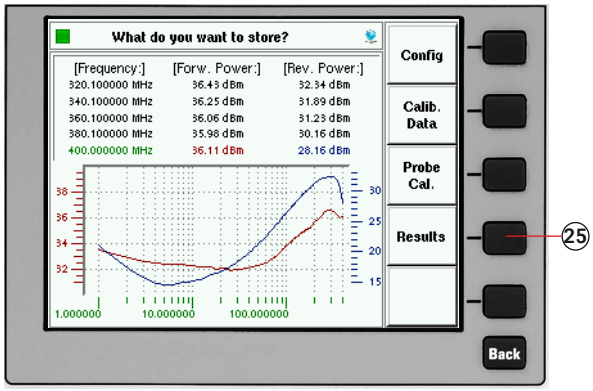


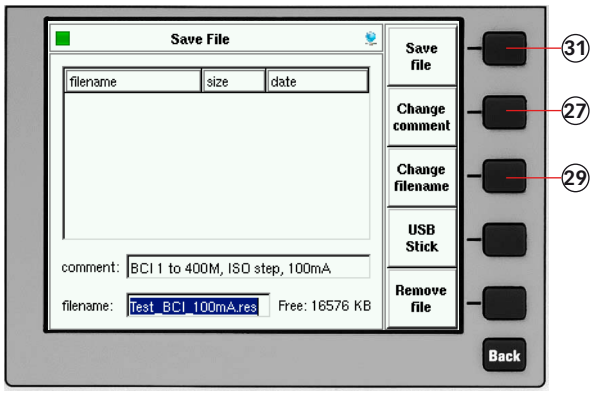
19. Press “RUN“ to start the test.
20. Press “HOLD“ to interrupt the sweep. (Caution! RF level is still present.)
21. Press “FRE“ or “LEV“ to select the test frequency or level.
22. Turn the knob to manually change the selected parameter.
23. Press “HOLD“ to continue the test.



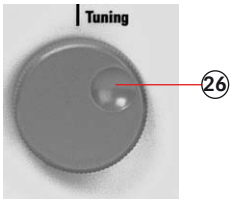






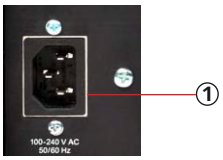


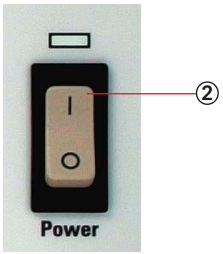
24. Press “STO” to store the result file.
25. Press “RESULTS”
26. Turn the knob to select a similar file comment or name. (optional)
27. Press “CHANGE COMMENT”
28. Type the comment on the connected keyboard.
29. Press “CHANGE FILENAME”
30. Type the name of the file on the connected keyboard.
31. Press “SAVE FILE”



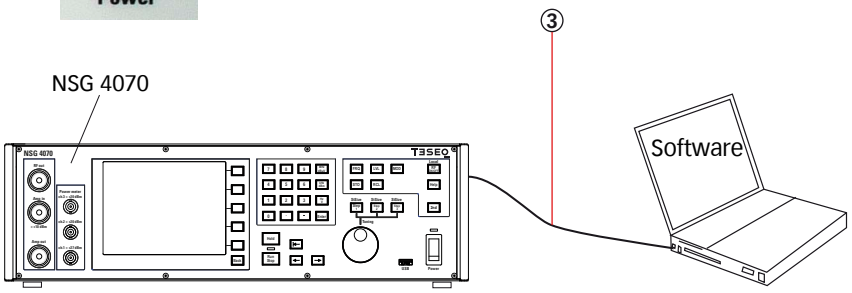
11.7. Example 7: Initiating the NSG 4070 control program

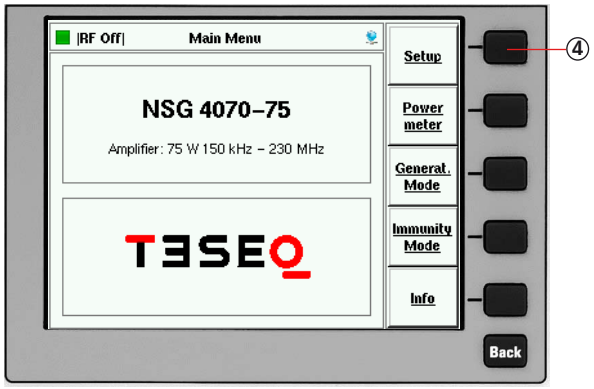
The following example shows how to set up the NSG 4070 for use with the Windows-based remote control program. Further examples are based on the steps shown in this example.

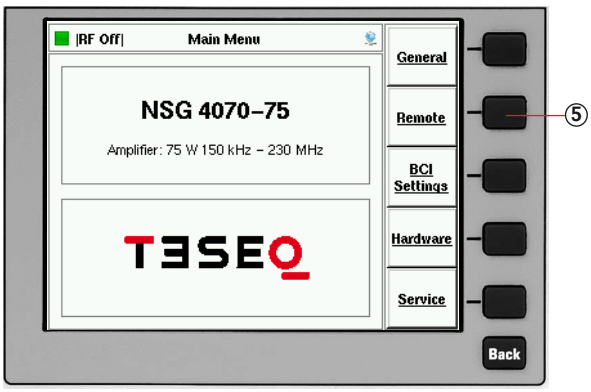


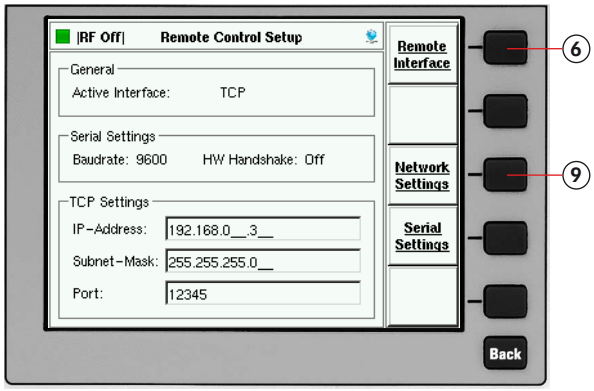


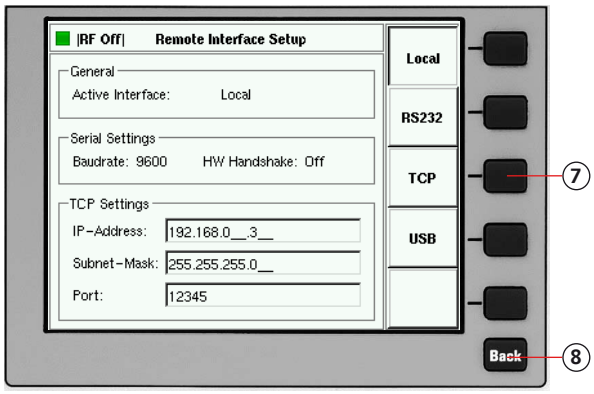
1. Connect the NSG 4070 with a suitable mains socket.
2. Switch the unit on.
3. Connect "LAN" to the PC with installed "NSG 4070 CONTROL PROGRAM"
4. Press "SETUP".
5. Press "REMOTE".

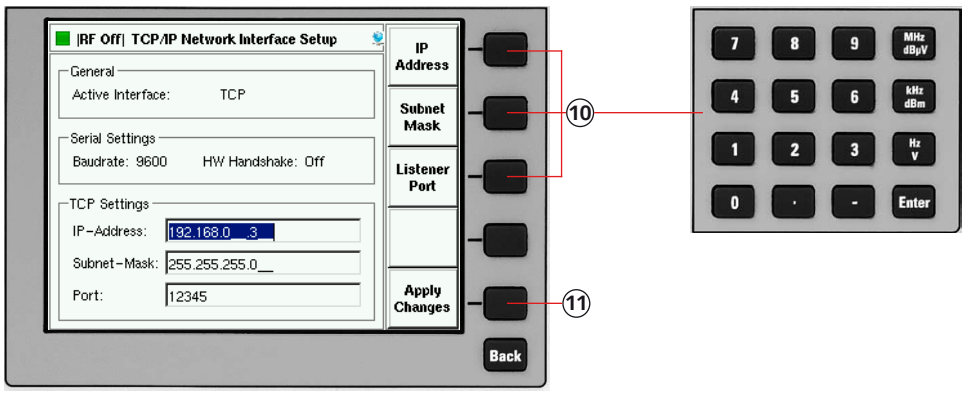


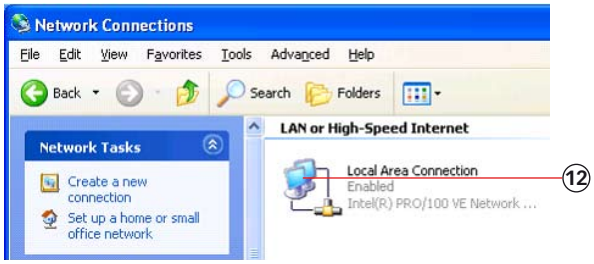










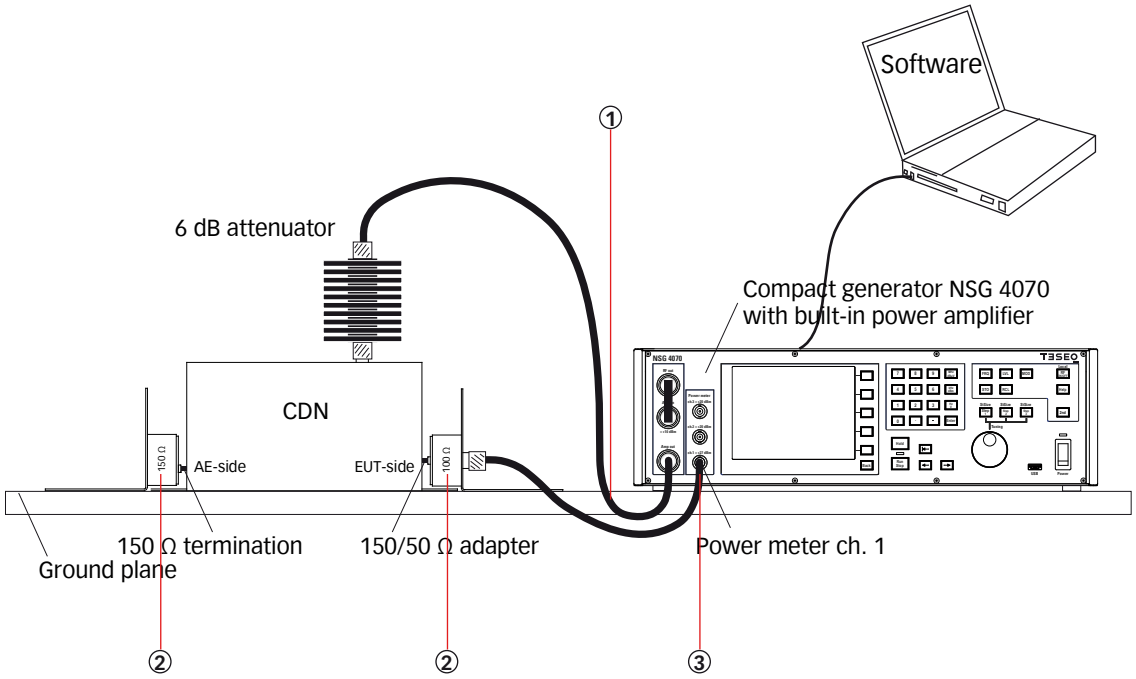


6. Press “REMOTE INTERFACE”.
7. Press “TCP”.
8. Press “BACK”
9. Press “NETWORK SETTINGS”
10. Change the settings as required.
11. Press “APPLY CHANGES”.
12. Change the network settings on the connected PC.

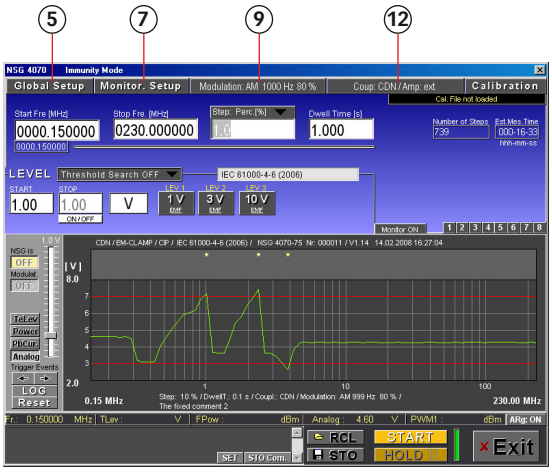
13. Start the "NSG 4070 CONTROL PROGRAM"
14. Click several times to select "NETWORK".
15. Click "CONNECT".

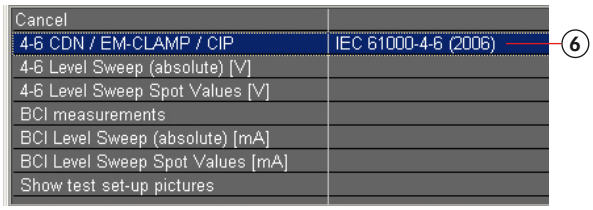
11.8. Example 8: NSG 4070 Control Program - IEC/EN 61000-4-6 testing with CDN

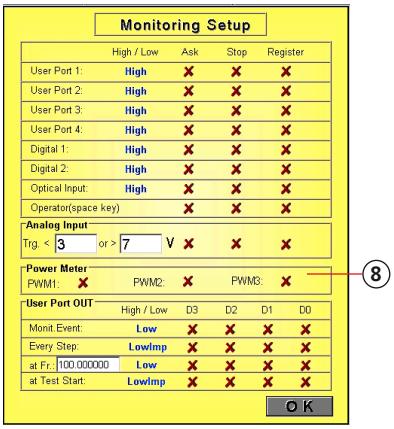
The following example shows the remote operation of the NSG 4070 for testing according IEC/EN 61000-4-6 with CDNs. This example requires a NSG 4070 with a built-in power amplifier, like the NSG 4070-20, NSG 4070-30 or NSG 4070-75. The CDN must be supplied with calibration adapters for level setting. A 6 dB attenuator and some RF cables are also required.

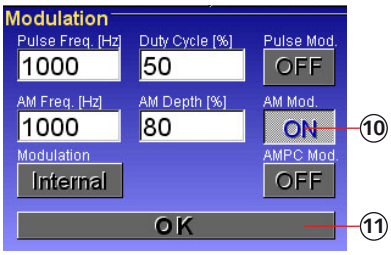


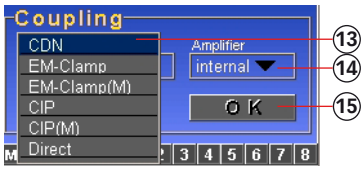
1. Connect "AMP out" to the 6 dB attenuator and the CDN.
2. Set up the CDN calibration adapters as shown in the CDN operating instructions.
3. Connect the 150/50 Ω adapter to the power meter channel 1.
4. Click "IMMUNITY".



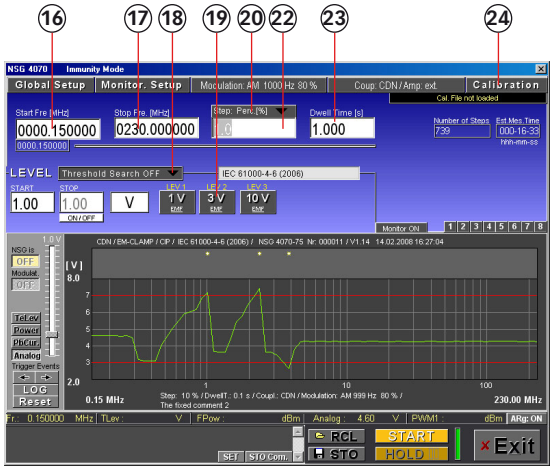


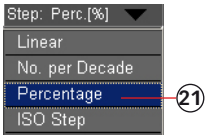


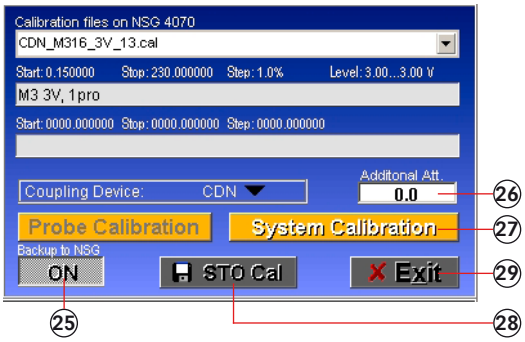


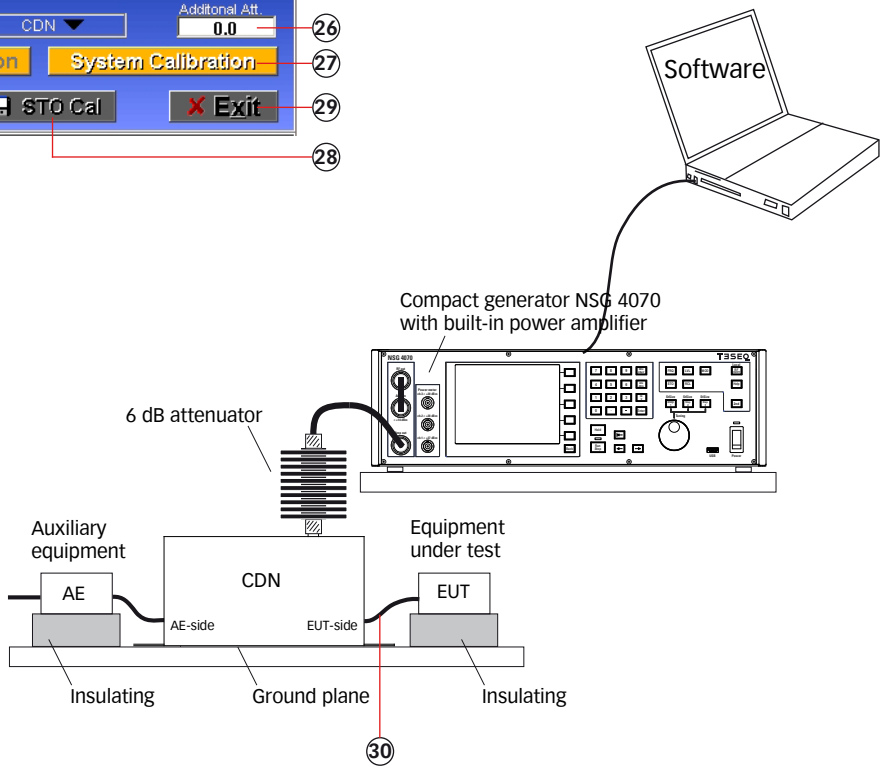


5. Click “GLOBAL SETUP”.
6. Select “4-6 CDN / EM CLAMP / CIP”.
7. Click “MONITOR. SETUP”.
8. Switch off all EUT monitoring ports for this example. Click to change and select “✕”.
9. Click “MODULATION ...”.
10. Change to 1000 Hz, 80% and AM.
11. Click “OK”.
12. Click “COUP: CDN ...”.
13. Select “CDN”.
14. Select amplifier “INTERNAL”.
15. Click “OK”.
16. Change the “START FREQ.” to “0.150”.

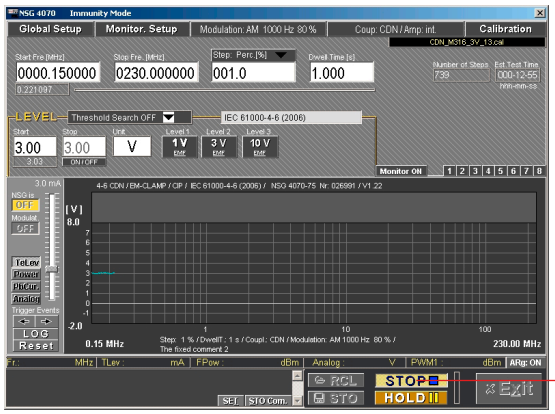


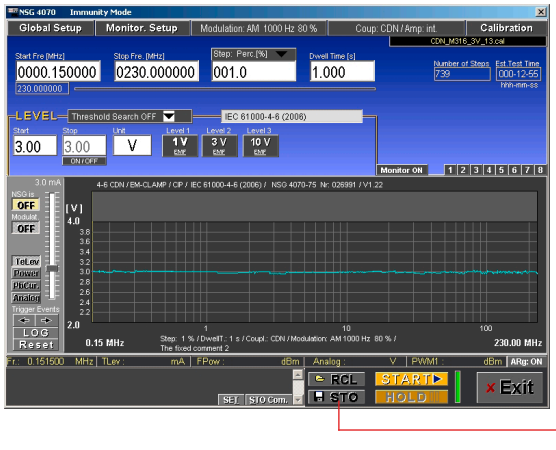


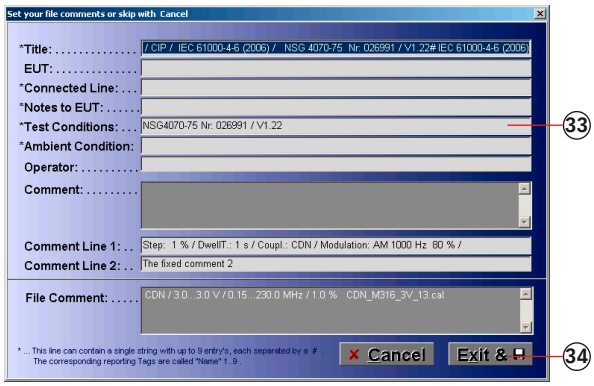




17. Change the "STOP FREQ." to "230".
18. Select "THRESHOLD SEARCH OFF".
19. Click "3 V EMF".
20. Click "STEP:....".
21. Select "PERCENTAGE".
22. Change the "STEP SIZE" to "1.0".
23. Change the "DWELL TIME" to "1.0".
24. Click "CALIBRATION".
25. Click "BACKUP TO NSG" "ON".
26. Change "ADDITIONAL ATT." to "0.0".
27. Click "SYSTEM CALIBRATION" and wait.
28. Click "STO CAL" to store the calibration result on the PC and NSG 4070.
29. Click "EXIT".
30. Remove the calibration adapters and connect the EUT.
31. Click "START" and wait until test is fin-





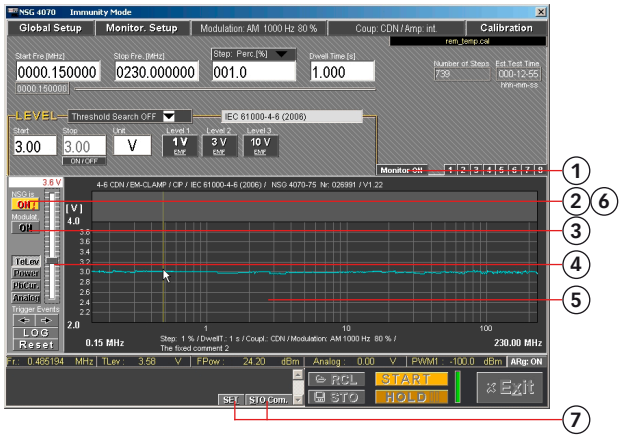


ished.

32. Click “STO”.
33. Fill out the test comments.
34. Click “EXIT & STORE” to store the results on the PC. A second window allows the user to change the path and file name.

11.9. Example 9: NSG 4070 Control Program - Manual test level and frequency change

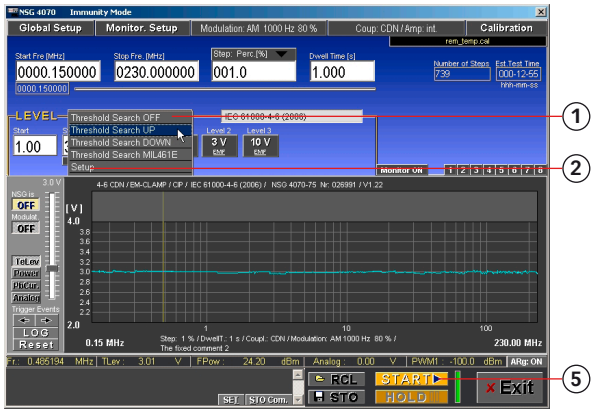
The following example shows the remote operation of the NSG 4070 for manually changing test frequency and level. This example can be performed direct following examples 7 and 8.

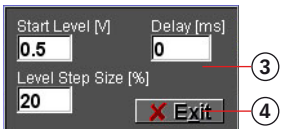


1. Click “MONITOR ON”.
2. Click “NSG ON”.
3. Click “MODULATION ON”.
4. Move the slider to change the “TEST LEVEL”.
5. Click inside the diagram to change the “TEST FREQUENCY”.
6. Click “NSG OFF”.
7. Use the “SET” and “STO COM” keys to insert a comment at the actual cursor frequency. Please note: After changing frequency comments it is necessary to store test results in a *.res file with the “STO” button.

11.10. Example 10: NSG 4070 Control Program - Threshold search

The following example shows the remote operation of the NSG 4070 for setting the threshold search. This example can be performed directly following examples 7 and 8.

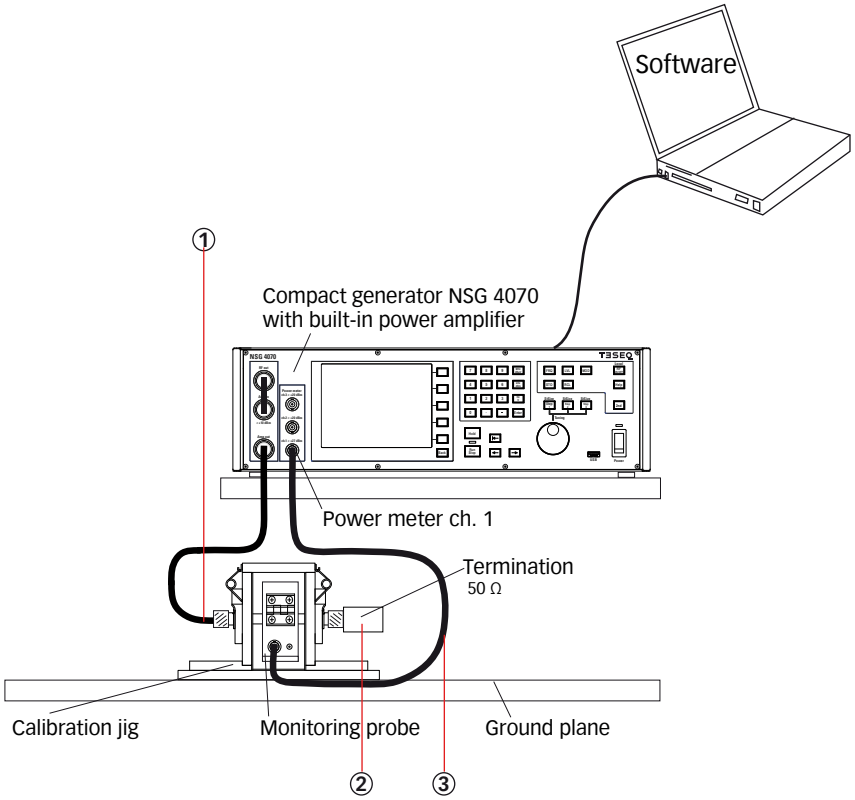




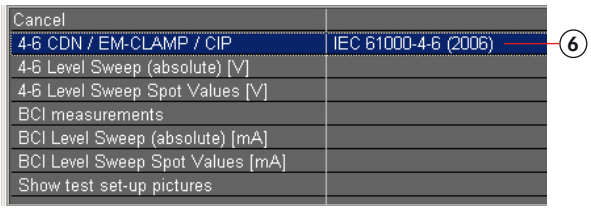
1. Select “THRESHOLD SEARCH UP”.
2. Click “SETUP”.
3. Change the parameter as required.
4. Click “EXIT”.
5. Click “START”.

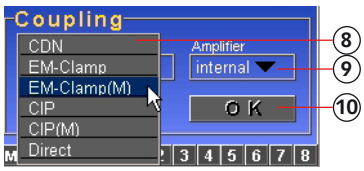
11.11. Example 11: NSG 4070 Control Program - Monitoring probe calibration for IEC/ EN 61000-4-6

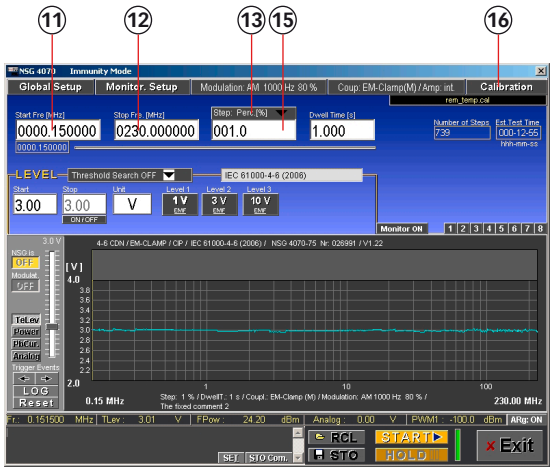
The following example shows the remote operation of the NSG 4070 for calibrating the monitoring probe. This example requires a NSG 4070 with a built-in power amplifier, like the NSG 4070-20, NSG 4070-30 or NSG 4070-75. The probe must be inserted in a 50 Ω calibration jig. A termination and some RF cables are also required.

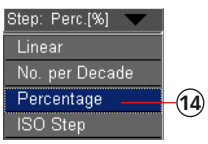


1. Connect “AMP out“ to the calibration jig.
2. Terminate one side of the calibration jig with 50 Ω.
3. Connect the monitoring probe output to the power meter channel 1.
4. Click “IMMUNITY“.

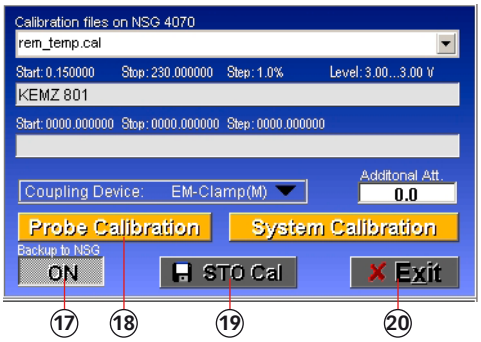








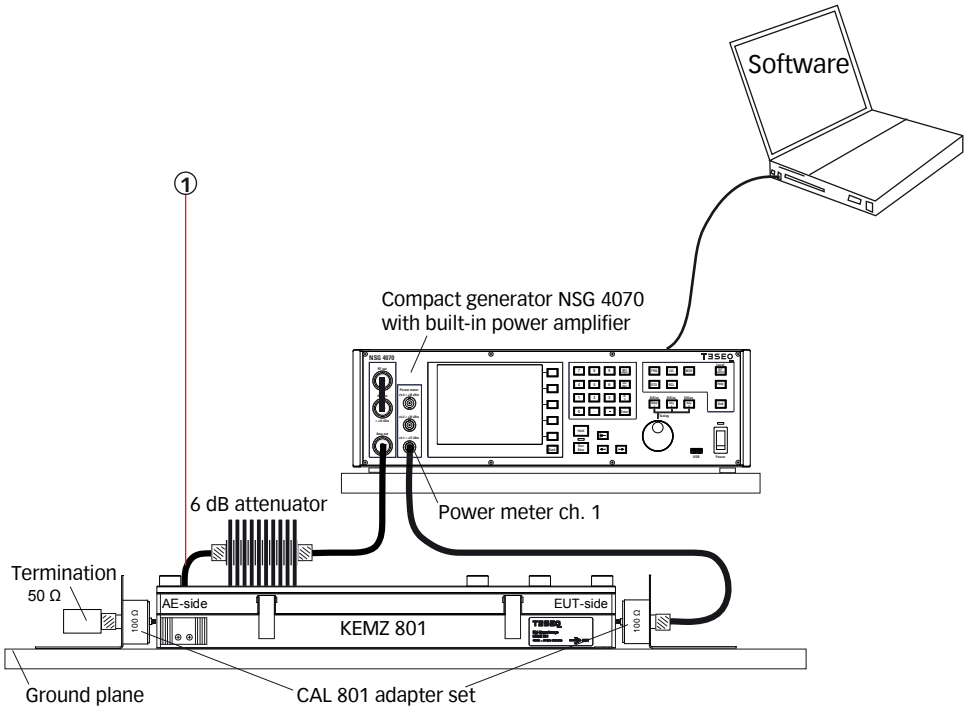
5. Click “GLOBAL SETUP”.
6. Select “4-6 CDN / EM CLAMP / CIP”.
7. Click “COUP: CDN ...”.
8. Select “EM-CLAMP (M)” or “CIP (M)”.
9. Select amplifier “INTERNAL”.
10. Click “OK”.
11. Change the “START FREQ.” to “0.150”.
12. Change the “STOP FREQ.” to “230”.
13. Click “STEP:.....”.
14. Select “PERCENTAGE”.
15. Change the “STEP SIZE” to “1.0”.
16. Click “CALIBRATION”.

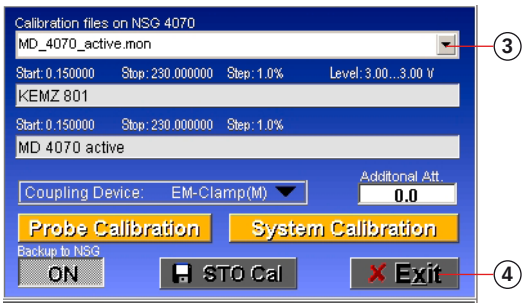


17. Click “BACKUP TO NSG” “ON”.
18. Click “PROBE CALIBRATION” and wait.
19. Click “STO CAL” to store the calibration result on the PC and NSG 4070.
20. Click “EXIT”.

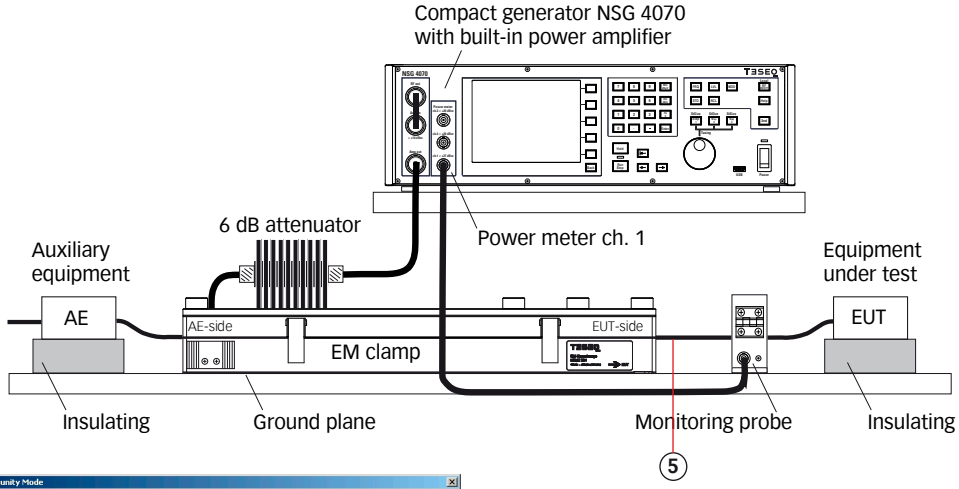
11.12. Example 12: NSG 4070 Control Program - IEC/EN 61000-4-6 testing with EM-clamp and monitoring probe

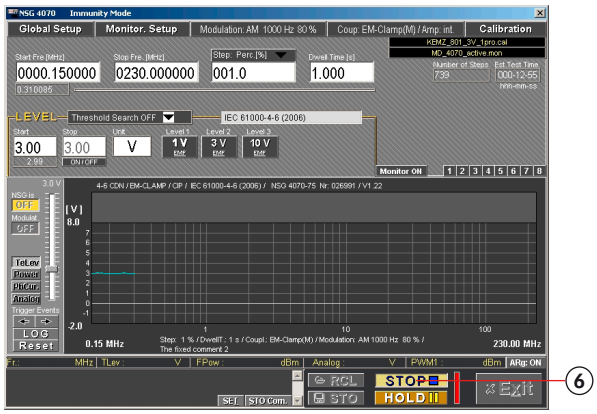
The following example is based on examples 7, 8 and 11 (Chapters 11.7, 11.8 and 11.11)- only the differences are shown. This example requires a NSG 4070 with a built-in power amplifier, like the NSG 4070-20, NSG 4070-30 or NSG 4070-75. An EM-clamp, monitoring probe, 6 dB attenuator and some RF cables are also required.

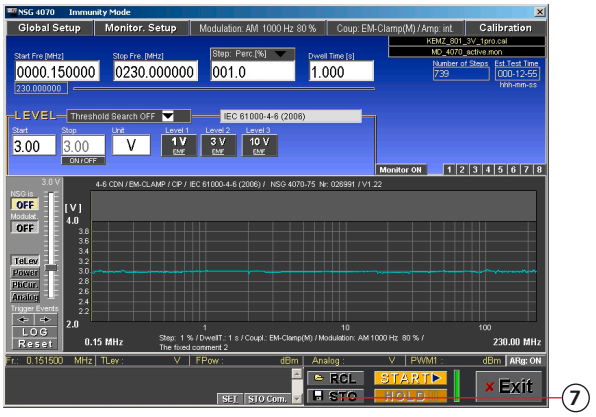


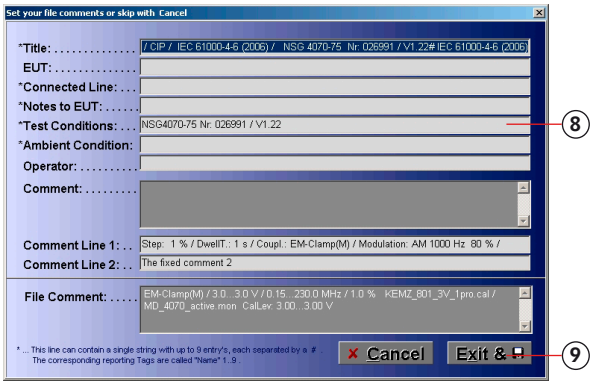


1. Connect the EM-Clamp as shown in the figure above.
2. Follow example 8 steps #4 to #30 with exception step #13. Select “EM-CLAMP (M)”
3. Recall the probe calibration file of example 11
4. Click “EXIT”.





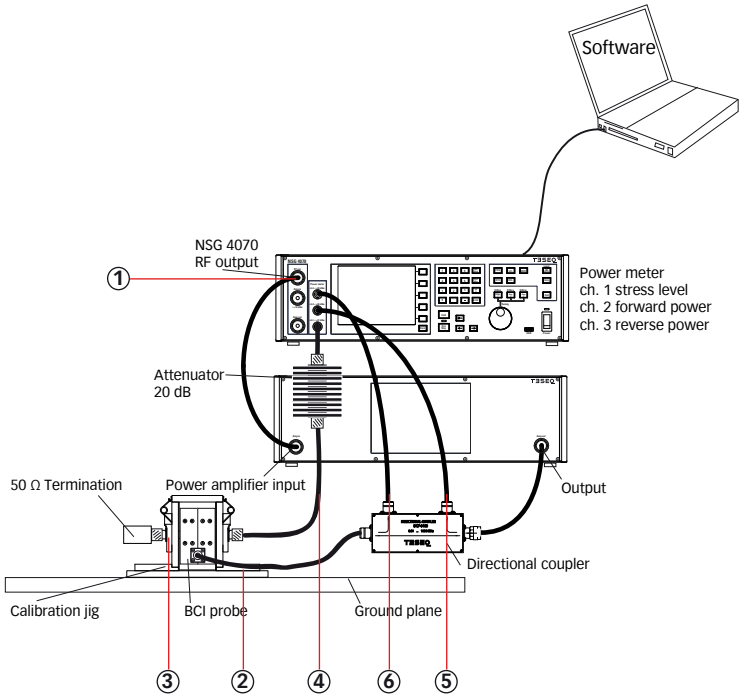


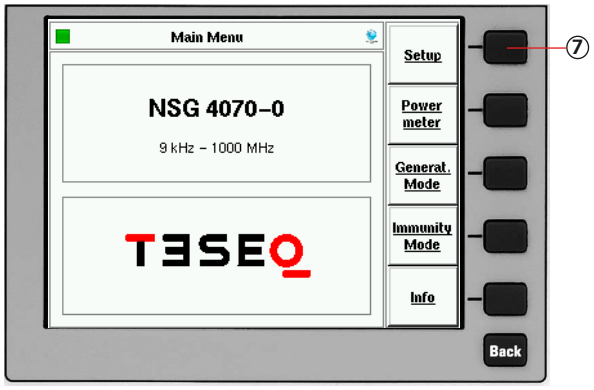


5. Connect the EM-Clamp and monitoring probe as shown in the figure above.
6. Click “START“ and wait until test is finished. (Please note any test with a coupling device and monitoring probe must have calibration files loaded for each unit.)
7. Click “STO“.
8. Fill out the test comments.
9. Click “EXIT & STORE“ to store the results on the PC. A second window allows the user to change the path and file name.

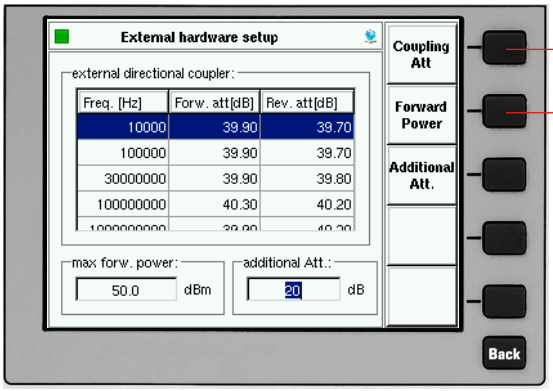
11.13. Example 13: NSG 4070 Control Program - BCI testing

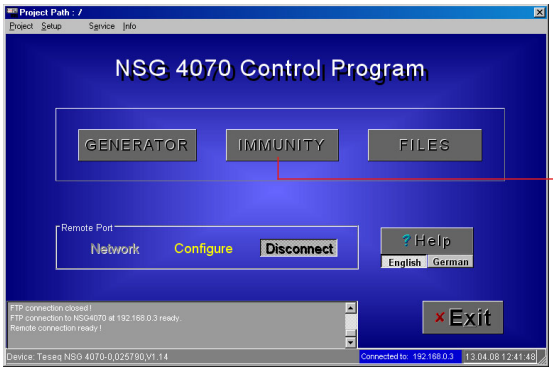
The following example shows the remote operation of the NSG 4070 for testing according ISO 11452-4. This example requires a NSG 4070, external directional coupler, external power amplifier, BCI probe and calibration jig. Attenuators to terminate the calibration jig and to protect the power meter are also required.

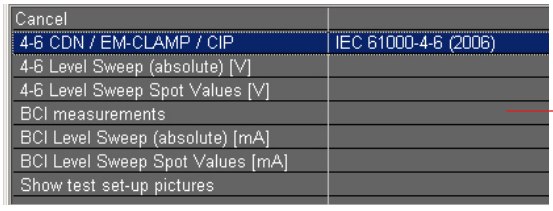


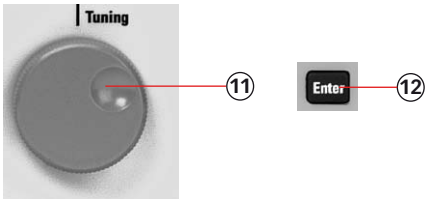


1. Connect "RF out" to the power amplifier input.
2. Connect the output of the power amplifier via the directional coupler to the BCI probe.
3. Set up the calibration jig and termination as shown in the figure below.
4. Connect one side of the calibration jig to the power meter channel 1.
5. Connect the directional coupler out to the power meter channel 2 to measure the forward power.
6. Connect the directional coupler out to the power meter channel 3 to measure the reverse power.
7. Press "SETUP".
8. Press "HARDWARE"

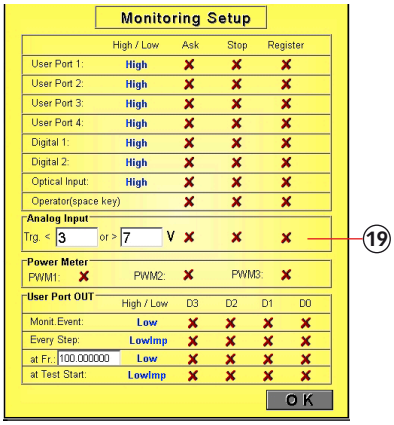


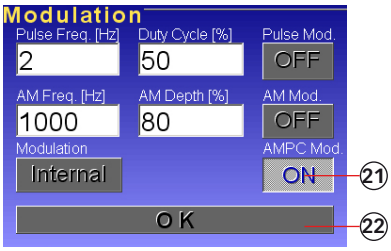




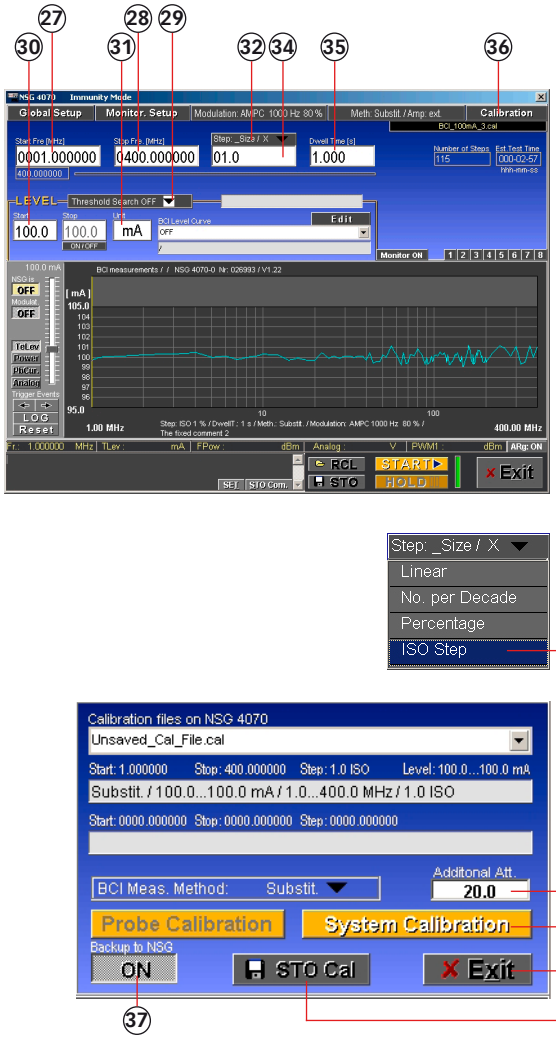


9. Insert the USB stick with the correction factors of the directional coupler and wait few seconds.
10. Press “COUPLING ATT.“
11. Turn the knob to select the file.
12. Press “ENTER“
13. Press “FORWARD POWER“ and change this limit as required by the hardware.
14. Follow example 7 and establish the remote operation.
15. Click “IMMUNITY“.
16. Click “GLOBAL SETUP“.
17. Select “BCI MEASUREMENTS“.

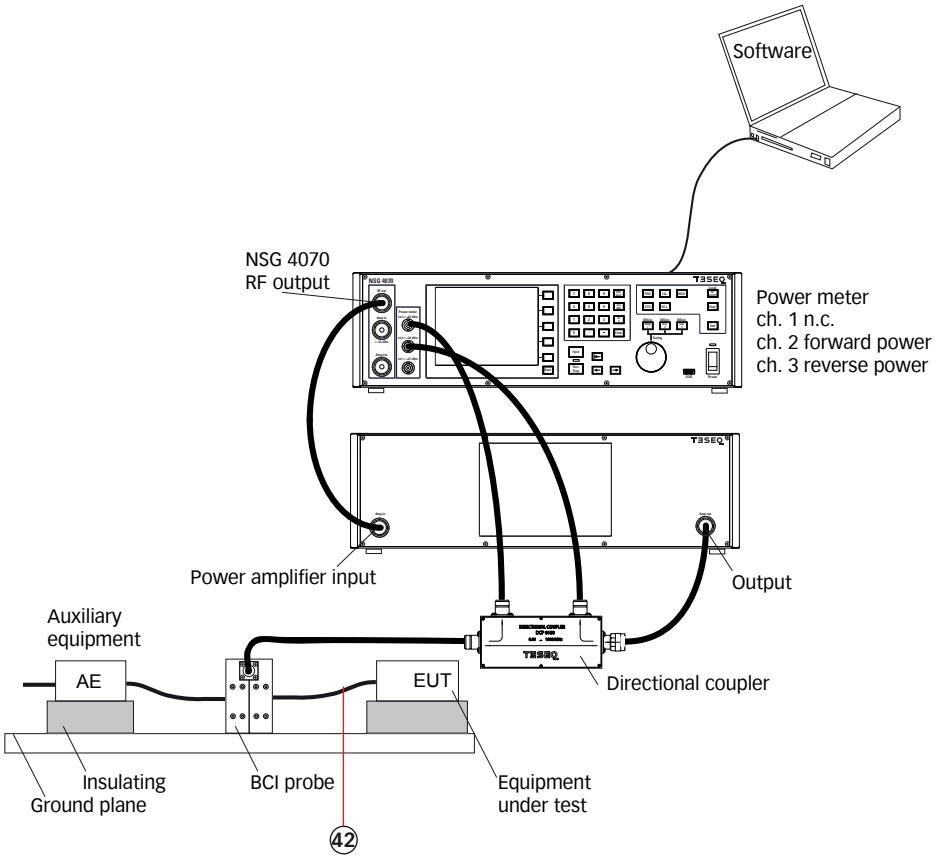


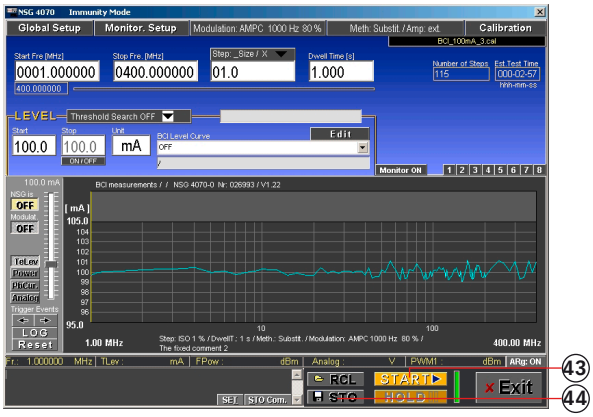


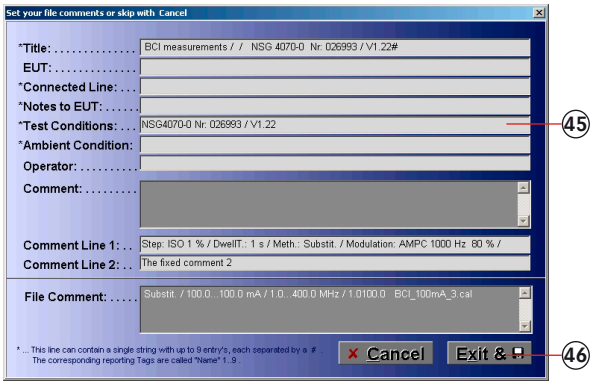
18. Click “MONITOR. SETUP”.
19. Switch off all EUT monitoring ports for this example. Click to select “✕”.
20. Click “MODULATION ...”.
21. Change to 1000 Hz, 80% and AM PC.
22. Click “OK”.
23. Click “METH: SUB. ...”.
24. Select “SUBSTIT.”.
25. Select amplifier “EXTERNAL”.
26. Click “OK”.
27. Change the “START FREQ.” to “1”.
28. Change the “STOP FREQ.” to “400”.



29. Select "THRESHOLD SEARCH OFF".
30. Change to "100".
31. Double click to change the unit to "mA".
32. Click "STEP:..."
33. Select "ISO STEP".
34. Change the "STEP SIZE" to "1.0".
35. Change the "DWELL TIME" to "1.0".
36. Click "CALIBRATION".
37. Click "BACKUP TO NSG" "ON".
38. Change "ADDITIONAL ATT." to "20.0".
39. Click "SYSTEM CALIBRATION" and wait.
40. Click "STO CAL" to store the calibration result on the PC and NSG 4070.
41. Click "EXIT".
42. Remove the calibration adapters and connect the EUT.



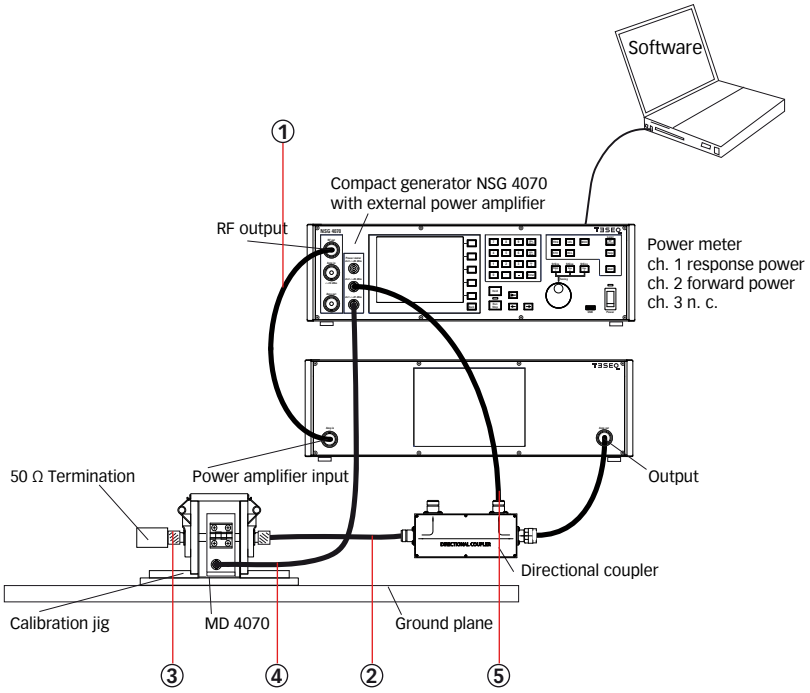


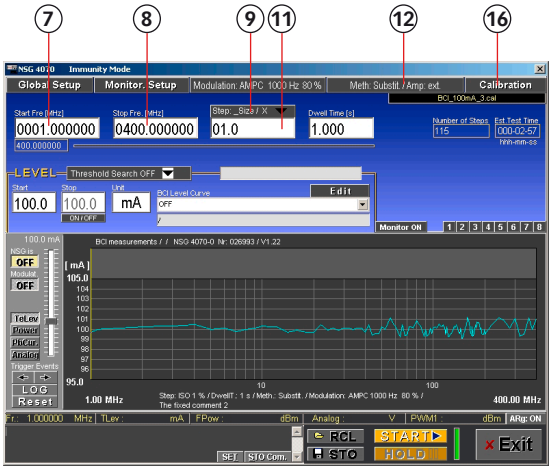


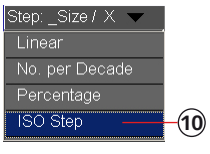
43. Click “START” and wait until test is finished.
44. Click “STO”.
45. Fill out the test comments.
46. Click “EXIT & STORE” to store the results on the PC. A second window allows the user to change the path and file name.

11.14. Example 14: NSG 4070 Control Program - Monitoring probe calibration for BCI

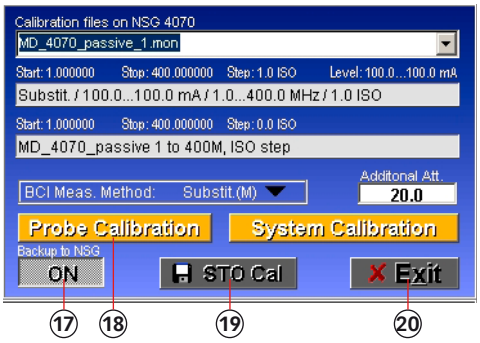
The following example shows the remote operation of the NSG 4070 for calibrating the monitoring probe for BCI applications. This example requires a NSG 4070, external directional coupler, external power amplifier, monitoring probe and calibration jig. A termination for the calibration jig is also required.







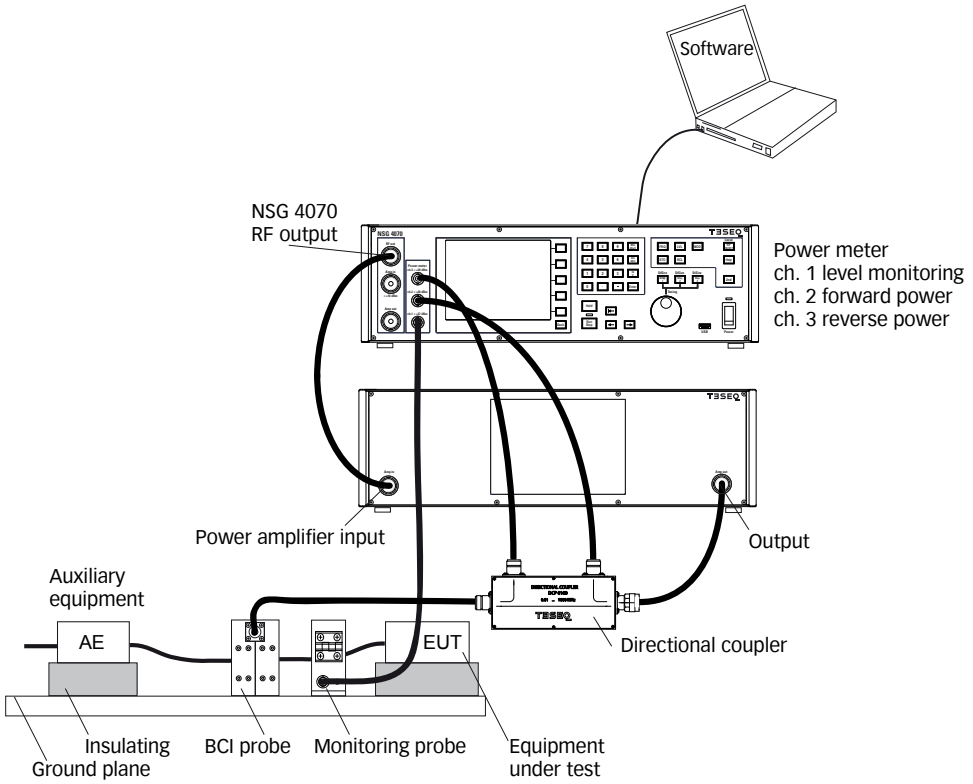
1. Connect “RF out” to the power amplifier input.
2. Connect the output of the power amplifier via the directional coupler to the calibration jig.
3. Terminate the calibration jig as shown in the figure below.
4. Connect the RF output of the probe to the power meter channel 1.
5. Connect the directional coupler out to the power meter channel 2 to measure the forward power.
6. Follow example 13 steps #7 to #17.
7. Change the “START FREQ.” to “1”.
8. Change the “STOP FREQ.” to “400”.
9. Click “STEP:...”
10. Select “ISO STEP”.
11. Change the “STEP SIZE” to “1.0”.
12. Click “METH: SUB. ...”.
13. Select “SUBSTITUTION (M)” or “CLOSED LOOP (M)”.
14. Select amplifier “EXTERNAL”.
15. Click “OK”.
16. Click “CALIBRATION”.

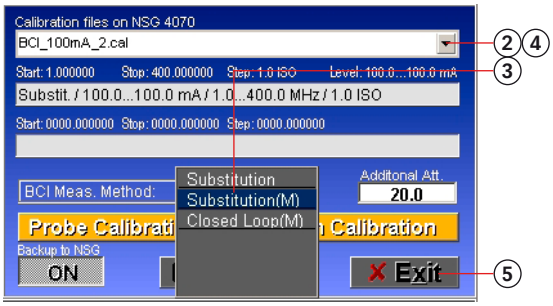


17. Click "BACKUP TO NSG" "ON".
18. Click "PROBE CALIBRATION" and wait.
19. Click "STO CAL" to store the calibration result on the PC and NSG 4070.
20. Click "EXIT".

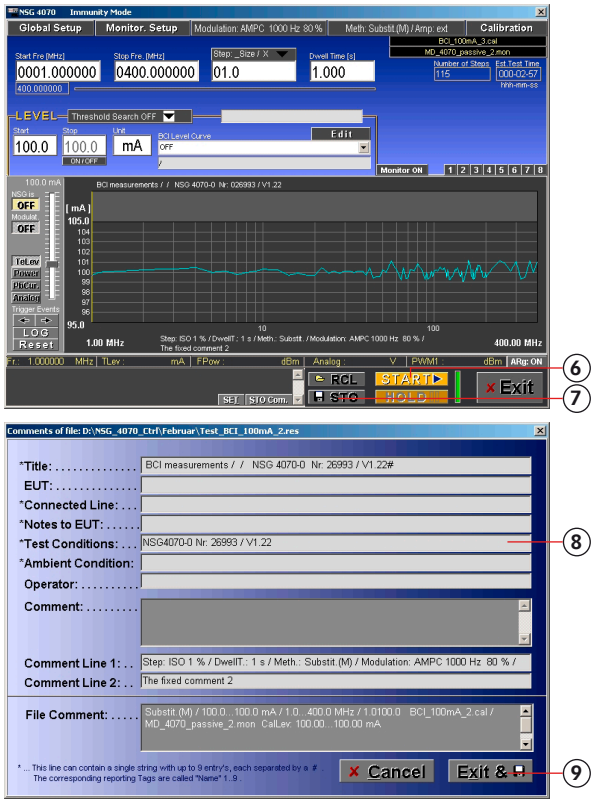
11.15. Example 15: NSG 4070 Control Program - BCI testing with monitoring probe

The following example is based on examples 7, 13 and 14 (chapter 11.7, 11.13 and 11.14) - only the differences are shown. This example requires a NSG 4070, external directional coupler, external power amplifier, BCI probe, monitoring probe and some RF cables.





1. Connect the BCI probe and monitoring probe as shown in the figure above.
2. Follow example 13 steps #1 to #40. The system calibration file should be loaded.
3. Select "SUBSTITUTION (M)" or "CLOSED LOOP (M)"
4. Recall the probe calibration file of example 14.
5. Click "EXIT"



6. Click “START” and wait until test is finished. (Please note any test with BCI and monitoring probe must have a calibration file loaded for each unit)
7. Click “STO”.
8. Fill out the test comments.
9. Click “EXIT & STORE” to store the results on the PC. A second window allows the user to change the path and file name.

11.16. Example 16: NSG 4070 Control Program - BCI testing with level curve

The following example is based on example 13 (chapter 11.13) - only the differences are shown.

1. Follow example 13 steps #1 to #26.
2. Change the “DWELL TIME” to “1.0”.
3. Select a “BCI LEVEL CURVE”.
4. Press “CALIBRATION”.
5. Follow example 13 steps #37 to #46.

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