



# **TEST SYSTEM FOR CONDUCTED AND RADIATED IMMUNITY NSG 4070B**

## **USER MANUAL**

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This manual is written for NSG 4070B. It is based on firmware version 2:12 and NSG 4070 Control Software version 1.2.0 (Build:5). Earlier user manual versions e01 to e05 should not be used for this unit.

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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**



**Protective earth**  
**(earth terminal)**

**First connect PE (protective earth) to the 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!
- Unplug the power cord when not using the unit for a long periods of time
- Handle the power cord carefully. Hold the plug when unplugging the cord.
- 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. Disconnection from the mains

- Always set the power switch to the "Off" position and wait few seconds before disconnecting the power cord.
- Disconnect the power cord and all connection cords when moving the unit.

**1.5. 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.

**1.6. 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. Operate the unit not in explosive surroundings.
- No objects filled with liquids, such as coffee cups, shall be placed on the unit.
- Do not insert foreign objects in the ventilation holes.
- Do not obstruct the ventilation holes (also on the underside). Ventilation should not be impeded by covering the ventilation openings with items or other equipment.
- Avoid high temperatures. Allow for sufficient heat dispersion when installed in a rack. Do not place the product on radiators or fan heaters. The ambient temperature must not exceed the maximum specified temperature of this product.

**1.7. Test execution**

- Check once again that all connections are proper and that there are not problems with the connection cords. 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.

**1.8. 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.
- Disruption of unrelated electronic, telecommunications or navigational installations or heart pacemakers through unintentional radiation of RF energy.

**1.9. 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.

**1.10. 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,

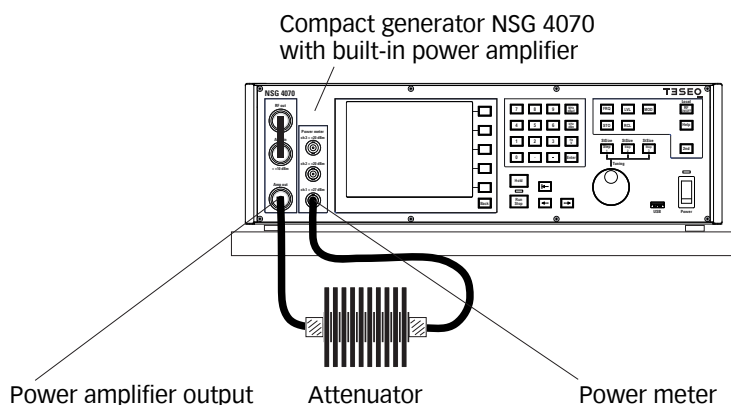
table 2 and chapter 7 class B and DIN EN 61010-1:2001

- 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.

### 1.11. Cautions on handling the power meters

#### Generator mode, power meter 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	Generator mode, power meter mode	Generator mode, power meter mode
Level	-30 dBm	-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



#### Caution:

Any input level above the limits of the power meter may **damage** or **destroy** the power meter. Such damage will not be handled by warranty.

**Immunity mode**

The immunity mode is less dangerous as long as the calibration set up will be used. Please avoid any direct connection between power amplifier output and power meter input. Please remove the connection to power meter 1 after the system calibration is finished. The amplitude modulation, as described for IEC/EN 61000-4-6, increases the forward power with 5.1 dB which could damage the connected power meter 1. Certainly a connection is required for e.g. measuring the current with a current probe. Please always respect the power limits of the connected power meters, current probes, attenuators and other hardware.

The operation mode "CALIBRATION OF THE MONITOR PROBE" is intended for measuring the insertion loss of attenuators, cables and probes. The direct connection is allowed between power amplifier output and power meter channel 1. It allows a safe operation. The required power is adjusted to the related attenuation and measuring range of the power meters. The maximum output of the power amplifier will be adjusted in case of an interrupted connection to the power meter channel 1. All the connected hardware needs to be suitable for this power. Less qualified hardware may get damaged (e.g. attenuators connected on the calibration jig).



## 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 4070B-0 Compact immunity test system NSG 4070, 9 kHz - 1 GHz RF generator and power meter (without power amplifier), country version GB, CH, USA/JP and EU
253882	NSG 4070B-35 Compact immunity test system NSG 4070, 9 kHz to 1 GHz RF generator and power meter (with 35 W module 150 kHz to 230 MHz), country version GB, CH, USA/JP and EU
253296	NSG 4070B-45 Compact immunity test system 9 kHz to 1 GHz, RF generator, power meter and 45 W power amplifier, country version GB, CH, USA/JP and EU
253883	NSG 4070B-80 Compact immunity test system NSG 4070, 9 kHz to 1 GHz RF generator and power meter (with 80 W module 150 kHz to 230 MHz), country version GB, CH, USA/JP and EU

97-253290	NSG 4070-TC Traceable calibration (ISO17025), order only with the device
98-253290	NSG 4070-DAkKS DAkKS calibration (ISO17025), order only with the device
253103	NSG 4070 Rack Rack mounting kit for NSG 4070
253850	SW 4070 Option for NSG 4070: RF-Switch network 2x SPDT
253900	MD 4070 Monitoring device (current sensing probe) active/passive with PSU 6001 and LE 242 in storage case
97-253900	MD 4070-TC Traceable calibration (ISO17025), order only with device MD 4070
252052	PCJ 9201B Calibration jig for current probes
252054	FIX MD4070 Positioning fixture for MD 4070 in PCJ 9201
253715	WIN 6000 Test house software with 15 months support
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)
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 <a href="http://www.teseq.com">www.teseq.com</a> .	

## 2.5. Scope of delivery

- NSG 4070 mainframe
- Operating manual
- Remote software and USB drivers 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)
- USO 4013 (USB to serial/optical converter with 20 m optical cable)

### 3. DESCRIPTION OF THE INSTRUMENT

#### 3.1. General

The NSG 4070 is a multi-functional device for carrying out EMC immunity tests to accompany development and conformity testing in accordance to IEC/EN 61000-4-6, IEC/EN 61000-4-3, IEC/EN 61000-4-20, IEC/EN 61000-4-21 and several automotive standards. Anyone who spends a considerable amount of time on test level setting, connecting EUT monitoring or writing test reports can now carry out immunity testing in a much more efficient manner with the 3rd generation of NSG 4070. Its modular set-up using internal or external amplifiers enable a large variety of applications. The powerful and easy to use firmware makes the NSG 4070 independent from an external PC and control software, however it can also be remote controlled for system operation. A state-of-the-art data transfer of test and measurement data for documentation is provided by USB stick to be 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.

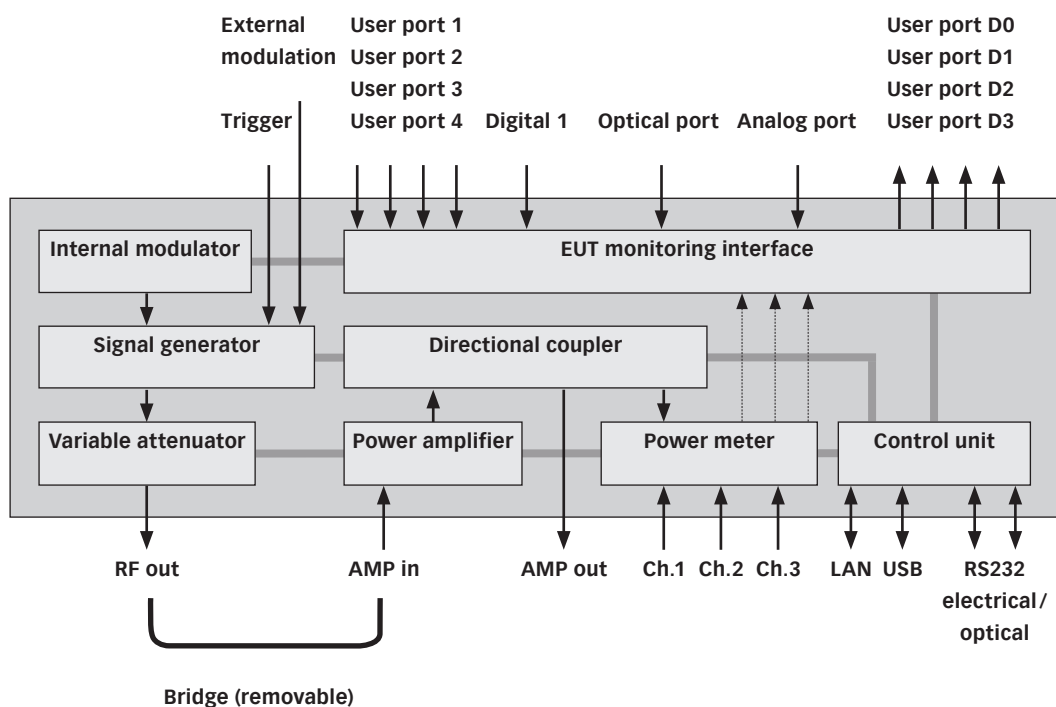


Figure 1: Block diagram of NSG 4070 with internal power amplifier

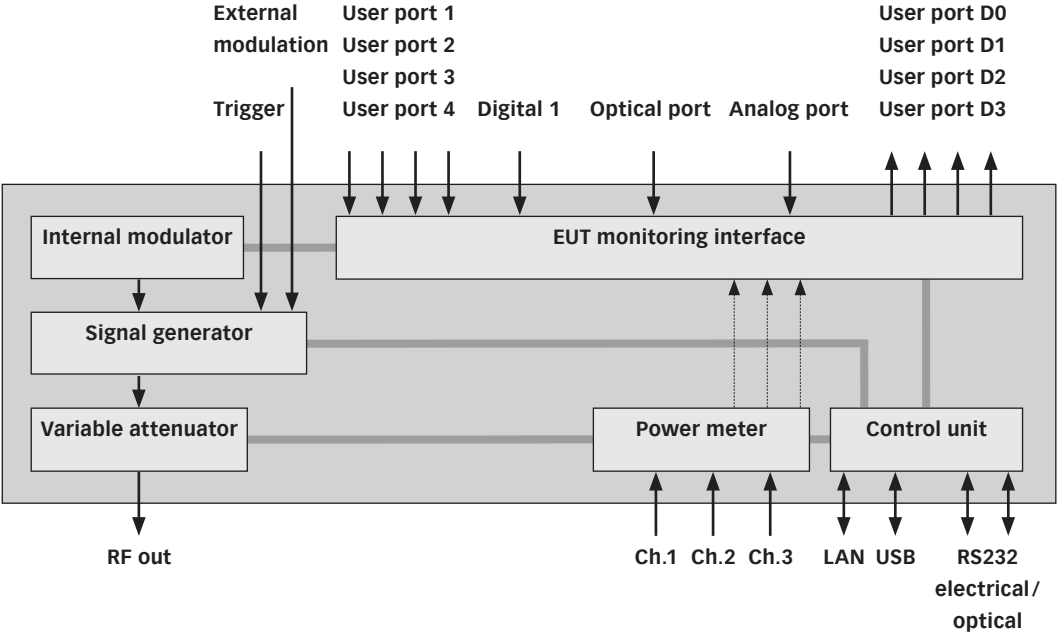


Figure 2: Block diagram of NSG 4070-0

3.2. Operating elements

3.2.1. Front panel

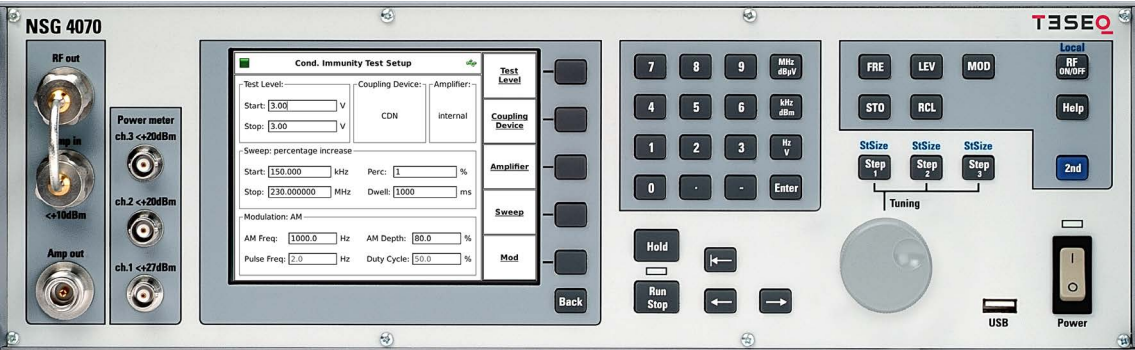



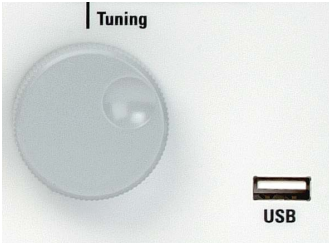

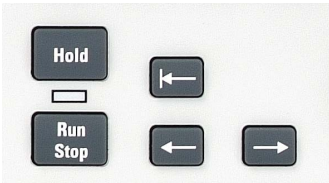
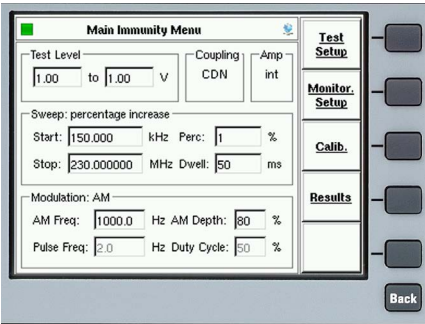




Figure 3: Front view of NSG 4070 with built-in power amplifier


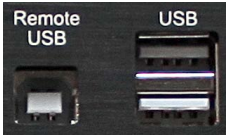
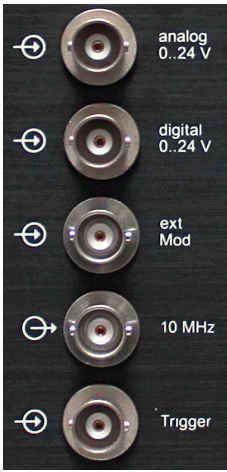

1		<b>Power</b>	<p><b>Power on key</b></p> <p>Hard key, switching takes effect with a short delay</p> <p>The LED next to the switch will turn from yellow to green when the unit is switched on.</p>
2		<b>FRQ</b>  <b>LVL</b>  <b>MOD</b>  <b>STO</b>  <b>RCL</b>  <b>Step 1, Step 2, Step 3</b>	<p><b>FRQ</b> Opens a softkey menu to change the frequency</p> <p><b>LVL</b> Opens a softkey menu to change the test level</p> <p><b>MOD</b> Opens a softkey menu to change the modulation parameters</p> <p><b>STO</b> Opens a softkey menu to store test data or configurations</p> <p><b>RCL</b> Opens a softkey menu to load test data or configurations</p> <p><b>Step 1, Step2, Step 3</b> Keys to select one of the three step sizes</p>
3		<b>RF ON/OFF</b>  <b>Help</b>         <b>2nd</b>	<p><b>RF ON/OFF</b> Switches the internal signal generator on/off</p> <p><b>Help</b> 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.</p> <p><b>2nd</b> Additional function: marked in blue color  <b>2nd + Local</b> Keys to switch from remote control to manual operation  <b>2nd + StSize</b> Keys to change the step size, affects e.g. the using of the rotary knob</p>

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

7		<p><b>Display</b></p> <p><b>Softkeys</b></p> <p><b>Back</b></p>	<p><b>Display</b> Displays menus, softkeys and results.</p> <p><b>5 Softkeys</b>, whose individual functions are dependent on the menu context.</p> <p><b>Back</b> Key to return from any operating condition (menu, canceling of entries, error messages) to the preceding higher-level menu</p>
8		<p><b>Power meter channel 1 to 3</b></p>	<p><b>Power meter inputs</b> Impedance <math>Z = 50 \Omega</math> 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.</p> <p>Channel 1 is used for calibration.</p>
9		<p><b>RF out</b></p> <p><b>Amp in</b></p> <p><b>Amp out</b></p>	<p><b>RF out</b> Synthesizer output to drive an external amplifier or use the NSG 4070 generator function.</p> <p><b>Amp in</b> Power amplifier input (the power amplifier is optional) Caution! Maximum input level &lt;+10 dBm.</p> <p><b>Amp out</b> Power amplifier output (the power amplifier is optional)</p>





13		<b>Monitor optical</b>	Input for optical EUT Monitoring, Fiber optic cable plug, HP versatile link HFBR0501 series 40 kBd
14		<b>Remote USB</b>	USB device connector
15		<b>Analog input</b>  <b>Digital input</b>  <b>Ext. Mod.</b>  <b>10 MHz</b>  <b>Trigger</b>	Monitoring input analog, BNC socket, 0-24 V $R_i=15\text{ k}\Omega$ , 6 mV resolution  Monitoring digital input, BNC socket, 0-24 V via optical coupler $R_i=1.5\text{ k}\Omega$ , switching threshold approx. 2 to 3 V  External modulation input, BNC socket, Impedance $>10\text{ k}\Omega$ , Level: 1 Vpp / 100% AM, 1 Hz – 50 kHz  10 MHz reference output, BNC socket, approx. 1 Vpp / $50\text{ }\Omega$ Please note: The connected signal will be mixed with the selected internal modulation. Disconnect this port for using the internal modulation only.  Trigger input BNC socket, TTL for external triggering
16		<b>Fans</b>	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).

#### **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:

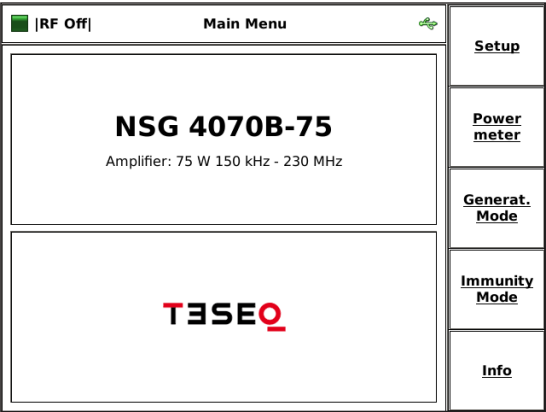
"CONFIG": To recall the settings from the internal flash or USB stick.

"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

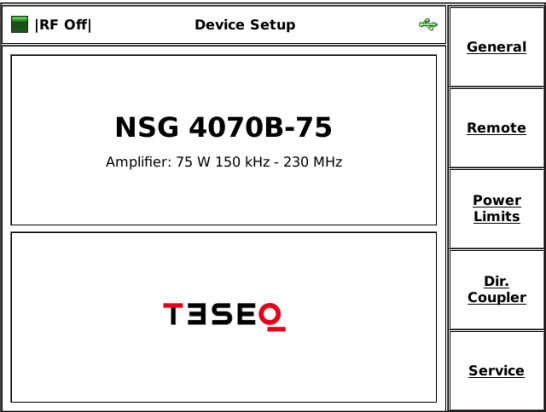
"RESULTS": To recall the measurement results together with the corresponding configuration from the internal flash or USB stick.

4.2. Main menu



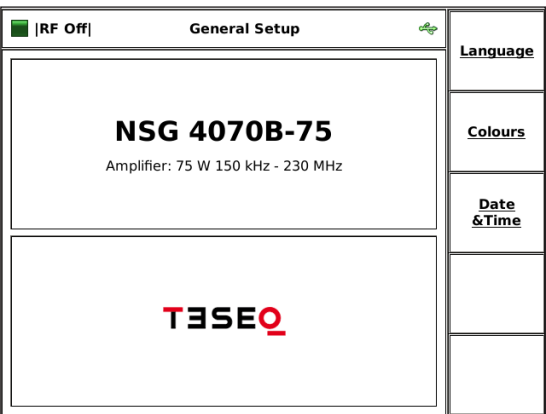
The “MAIN” menu of the NSG 4070 is always displayed after switching on the device. The “MAIN” menu provides the following choices: The “SETUP” menu provides access to general configurations. The “POWER METER” mode and “GENERATOR MODE” allow using the unit as RF generator. The “IMMUNITY MODE” gives the functionality for doing EMC testing. The “INFO” menu shows information about the hardware/software configuration and device serial number.

4.3. Setup



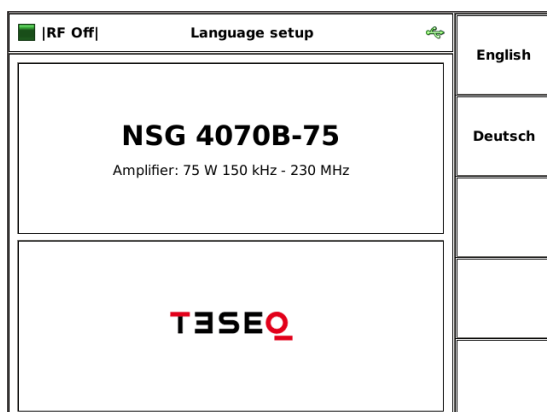
“DEVICE SETUP” provides access to the device configuration.

4.3.1. Setup —> General



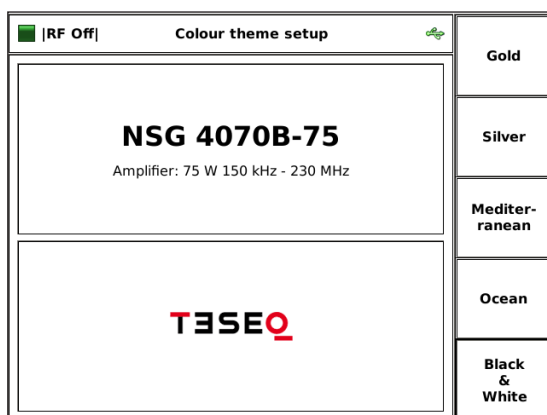
“GENERAL SETUP” provides access to the language, display colors and date & time configurations.

#### 4.3.1.1. Setup → General → Language setup



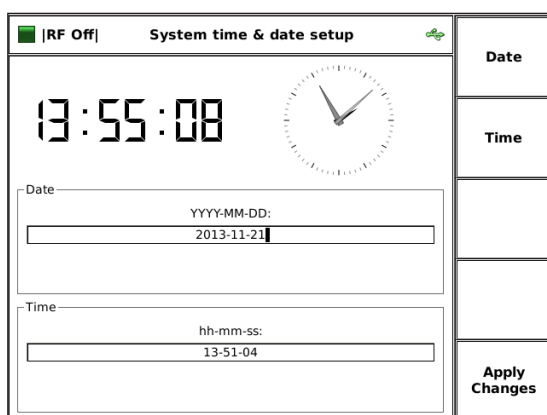
Language can be selected in this setup. The unit needs to be restarted after changing the language.

#### 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

<div>RF Off</div> <div>Remote Interface Setup</div>		
<div>General</div> <div>Active Interface: Local</div>		Local
<div>Baudrate Settings</div> <div>Baudrate: 115200</div>		RS232 electrical
<div>TCP Settings</div> <div>IP-Address: 192.168.0.3</div> <div>Subnet-Mask: 255.255.255.0</div> <div>Port: 12345</div>		RS232 optical
		TCP
		USB

“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

<div>RF Off</div> <div>Remote Interface Setup</div>		
<div>General</div> <div>Active Interface: Optical</div> <div></div>		Local
<div>Baudrate Settings</div> <div>Baudrate: 115200</div>		RS232 electrical
<div>TCP Settings</div> <div>IP-Address: 192.168.0.3</div> <div>Subnet-Mask: 255.255.255.0</div> <div>Port: 12345</div>		RS232 optical
		TCP
		USB

“REMOTE INTERFACE SETUP” allows the user to change the remote port. The selection “LOCAL” prohibits remote control. The selection “RS232 OPTICAL” provides a picture for helping the correct connection.

<div>RF Off</div> <div>Remote Interface Setup</div>		
<div>General</div> <div>Active Interface: RS232</div>		Local
		RS232

■ RS232 electrical is selected as remote interface.

<div>RF Off</div> <div>Remote Interface Setup</div>		
<div>General</div> <div>Active Interface: TCP</div>		Local
		RS232

■ TCP is selected as remote interface.

<div>RF Off</div> <div>Remote Interface Setup</div>		
<div>General</div> <div>Active Interface: USB</div>		Local
		RS232

■ USB is selected as remote interface.

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

TCP/IP Network Interface Setup

General

Active Interface: TCP

Baudrate Settings

Baudrate: 115200

TCP Settings

IP-Address: 192.168.0.3

Subnet-Mask: 255.255.255.0

Port: 12345

IP Address

Subnet Mask

Listener Port

Apply Changes

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

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

Remote Control Setup

General

Active Interface: RS232

Baudrate Settings

Baudrate: 115200

TCP Settings

IP-Address: 192.168.0.3

Subnet-Mask: 255.255.255.0

Port: 12345

Remote Interface

Network Settings

Baudrate 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.

Serial Interface Baudrate Setup

General

Active Interface: RS232

Baudrate Settings

Baudrate: 115200

TCP Settings

IP-Address: 192.168.0.3

Subnet-Mask: 255.255.255.0

Port: 12345

9600 Baud

19200 Baud

38400 Baud

57600 Baud

115200 Baud

Baudrate can be chosen in the baudrate setup. The default value is 115200 baud.

4.3.3. Setup —> Power limitations

RF Off

Power Limitations

Power factor k:  

4.00

Additional att.:  

0.0

 dB

Max. Amp out:  

55.0

 dBm

Max. RF out:  

10.0

 dBm

Factor k

Additional Att.

Max. Amp Out

Max. RF Out

The menu “POWER LIMITATIONS” allows the user to set system limits.

The “FACTOR K” is a power limitation factor as described in the ISO 11452-4 standard. The default value is 4. (See chapter 8.3.7 for more information.)

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. Enter 10 for an attenuator of 10 dB. Enter -9.5 for doing a “SYSTEM CALIBRATION” regarding IEC / EN 61000-4-6 in a 50 Ω system (Current injection probe in a 50 Ω jig).

The softkey “MAX. AMP OUT.” allows the user to set a limit for the maximum forward power.

The softkey “MAX. RF OUT.” allows the user to set a limit for the maximum generator power (RF output of NSG 4070).

4.3.4. Setup —> Directional coupler

RF Off

Directional Coupler

external directional coupler:

Freq. [Hz]	Forw. att[dB]	Rev. att[dB]
10000	39.90	39.70
100000	39.90	39.70
30000000	39.90	39.80
100000000	40.30	40.20
1000000000	39.90	40.20

Coupling Att

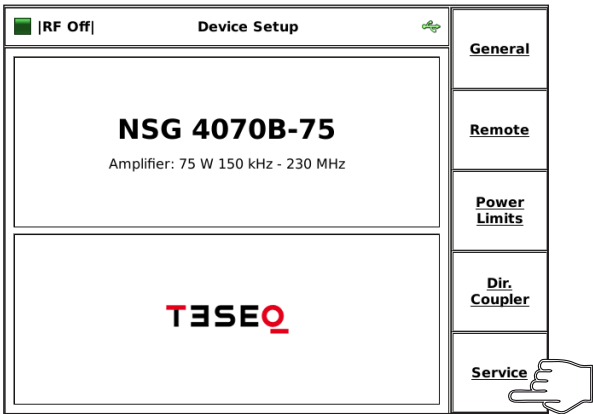
The softkey “COUPLING ATTENUATION” offers the import function for the coupling attenuation calibration factors of the external directional coupler.

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:

```
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

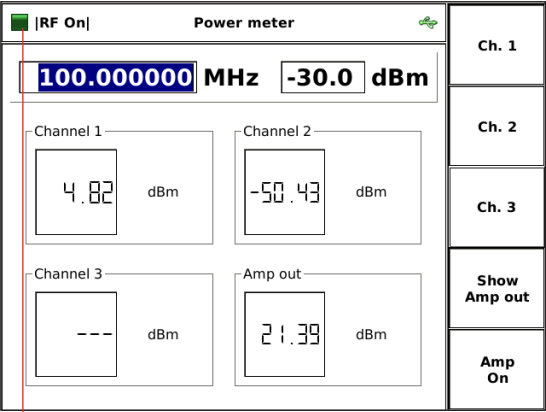


The “SERVICE MENU” is password protected and only accessible by authorized Teseq service personnel.

4.4. Power meter menu

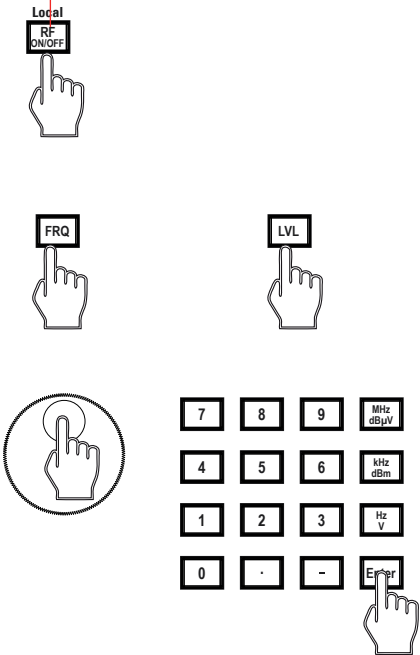
Turn modulation off to get correct results!

A warning note appears to remind the user for switching off the modulation. Otherwise strange power meter values may occur.



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

Main Immunity Menu			Test Setup
Test Level:	Coupling Device:	Amplifier:	<b>Monitor Setup</b>
Start: <input type="text" value="3.00"/> V Stop: <input type="text" value="3.00"/> V	CDN	internal	
Sweep: percentage increase			<b>Calib.</b>
Start: <input type="text" value="150.000"/> kHz Stop: <input type="text" value="230.000000"/> MHz	Perc: <input type="text" value="1"/> % Dwell: <input type="text" value="1000"/> ms		
Modulation: AM			<b>Results</b>
AM Freq: <input type="text" value="1000.0"/> Hz Pulse Freq: <input type="text" value="2.0"/> Hz	AM Depth: <input type="text" value="80.0"/> % Duty Cycle: <input type="text" value="50.0"/> %		

The "MAIN IMMUNITY MENU" gives an overview of the test parameters. The example shows a test according IEC/EN 61000-4-6 with following test parameter:

Test level: 1 V, coupling device: CDN, amplifier: internal, start frequency: 150 kHz, stop frequency: 230 MHz, step size: 10%, dwell time: 1100 ms, modulation: AM, modulation frequency: 1000 Hz, modulation depth: 80%. The parameter can be changed in the menu "TEST SETUP".

Select "BCI" in the menu "COUPLING DEVICE" for doing Automotive BCI testing. See next example.

Main Immunity Menu			Test Setup
Test Level:	Coupling Device:	Amplifier:	<b>Monitor Setup</b>
Start: <input type="text" value="100.0"/> mA Stop: <input type="text" value="100.0"/> mA	BCI	external	
Sweep: ISO 11452 steps			<b>Calib.</b>
Start: <input type="text" value="1"/> MHz Stop: <input type="text" value="400"/> MHz	ISO: <input type="text" value="1"/> Dwell: <input type="text" value="1000"/> ms		
Modulation: AM PC			<b>Results</b>
AM Freq: <input type="text" value="1000.0"/> Hz Pulse Freq: <input type="text" value="2.0"/> Hz	AM Depth: <input type="text" value="80.0"/> % Duty Cycle: <input type="text" value="50.0"/> %		

The example shows an Automotive BCI test with following test parameter:

Test level: 100 mA, coupling device: BCI, start frequency: 1 MHz, stop frequency: 400 MHz, step size: 1 (according table in ISO 11452-1), dwell time: 1000 ms, modulation: AM PC, modulation frequency: 1000 Hz, modulation depth: 80%. The parameter can be changed in the menu "TEST SETUP".

Select e.g. "CDN" in the menu "COUPLING DEVICE" for return to IEC/EN 61000-4-6 testing. See previous example.

### 4.5.1. Immunity menu —> Test Setup

Main Immunity Menu			Test Setup
Test Level:	Coupling Device:	Amplifier:	<b>Monitor Setup</b>
Start: <input type="text" value="3.00"/> V Stop: <input type="text" value="3.00"/> V	CDN	internal	
Sweep: percentage increase			<b>Calib.</b>
Start: <input type="text" value="150.000"/> kHz Stop: <input type="text" value="230.000000"/> MHz	Perc: <input type="text" value="1"/> % Dwell: <input type="text" value="1000"/> ms		
Modulation: AM			<b>Results</b>
AM Freq: <input type="text" value="1000.0"/> Hz Pulse Freq: <input type="text" value="2.0"/> Hz	AM Depth: <input type="text" value="80.0"/> % Duty Cycle: <input type="text" value="50.0"/> %		

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

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

Select a Test Level		
Test Level:	Coupling Device:	Amplifier:
Start: <input type="text" value="3.00"/> V	CDN	internal
Stop: <input type="text" value="3.00"/> V		
Sweep: percentage increase		
Start: <input type="text" value="150.000"/> kHz	Perc: <input type="text" value="1"/> %	
Stop: <input type="text" value="230.000000"/> MHz	Dwell: <input type="text" value="1000"/> ms	
Modulation: AM		
AM Freq: <input type="text" value="1000.0"/> Hz	AM Depth: <input type="text" value="80.0"/> %	
Pulse Freq: <input type="text" value="2.0"/> Hz	Duty Cycle: <input type="text" value="50.0"/> %	

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		
Test Level:	Coupling Device:	Amplifier:
Start: <input type="text" value="3.00"/> V	CDN	internal
Stop: <input type="text" value="3.00"/> V		
Sweep: percentage increase		
Start: <input type="text" value="150.000"/> kHz	Perc: <input type="text" value="1"/> %	
Stop: <input type="text" value="230.000000"/> MHz	Dwell: <input type="text" value="1000"/> ms	
Modulation: AM		
AM Freq: <input type="text" value="1000.0"/> Hz	AM Depth: <input type="text" value="80.0"/> %	
Pulse Freq: <input type="text" value="2.0"/> Hz	Duty Cycle: <input type="text" value="50.0"/> %	

“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 unit is 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

Select Coupling Device		
Test Level:	Coupling Device:	Amplifier:
Start: <input type="text" value="3.00"/> V	CDN	internal
Stop: <input type="text" value="3.00"/> V		
Sweep: percentage increase		
Start: <input type="text" value="150.000"/> kHz	Perc: <input type="text" value="1"/> %	
Stop: <input type="text" value="230.000000"/> MHz	Dwell: <input type="text" value="1000"/> ms	
Modulation: AM		
AM Freq: <input type="text" value="1000.0"/> Hz	AM Depth: <input type="text" value="80.0"/> %	
Pulse Freq: <input type="text" value="2.0"/> Hz	Duty Cycle: <input type="text" value="50.0"/> %	

IEC / EN 61000-4-6:  
The user can choose whether or not to test with a monitoring current probe in the path to the EUT if using EM clamp or current clamp (CIP). The operation “WITH PROBE” requires a loaded probe calibration file in addition to the system calibration file.

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

Select BCI Method		
Test Level:	Coupling Device:	Amplifier:
Start: <input type="text" value="100.0"/> mA	BCI	external
Stop: <input type="text" value="100.0"/> mA		
Sweep: ISO 11452 steps		
Start: <input type="text" value="1"/> MHz	ISO: <input type="text" value="1"/>	
Stop: <input type="text" value="400"/> MHz	Dwell: <input type="text" value="1000"/> ms	
Modulation: AM PC		
AM Freq: <input type="text" value="1000.0"/> Hz	AM Depth: <input type="text" value="80.0"/> %	
Pulse Freq: <input type="text" value="2.0"/> Hz	Duty Cycle: <input type="text" value="50.0"/> %	

“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” and the Closed loop method require a probe in the path to the EUT and a loaded probe calibration file in addition to the system calibration file.

No test level limitation takes place using Substitution method with a current probe.

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		
Test Level:	Coupling Device:	Amplifier:
Start: <input type="text" value="3.00"/> V	CDN	internal
Stop: <input type="text" value="3.00"/> V		
Sweep: percentage increase		
Start: <input type="text" value="150.000"/> kHz	Perc: <input type="text" value="1"/> %	
Stop: <input type="text" value="230.000000"/> MHz	Dwell: <input type="text" value="1000"/> ms	
Modulation: AM		
AM Freq: <input type="text" value="1000.0"/> Hz	AM Depth: <input type="text" value="80.0"/> %	
Pulse Freq: <input type="text" value="2.0"/> Hz	Duty Cycle: <input type="text" value="50.0"/> %	

“SELECT AMPLIFIER” allows the user to select an internal or external power amplifier. “MIXED” allows to use the internal power amplifier with an external directional coupler.

These options are not available for NSG 4070-0.

#### 4.5.1.4. Immunity menu —> Test setup —> Sweep

Cond. Immunity Sweep Setup		
Test Level:	Coupling Device:	Amplifier:
Start: <input type="text" value="3.00"/> V	CDN	internal
Stop: <input type="text" value="3.00"/> V		
Sweep: percentage increase		
Start: <input type="text" value="150.000"/> kHz	Perc: <input type="text" value="1"/> %	
Stop: <input type="text" value="230.000000"/> MHz	Dwell: <input type="text" value="1000"/> ms	
Modulation: AM		
AM Freq: <input type="text" value="1000.0"/> Hz	AM Depth: <input type="text" value="80.0"/> %	
Pulse Freq: <input type="text" value="2.0"/> Hz	Duty Cycle: <input type="text" value="50.0"/> %	

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

Test Level:

Start: 3.00 V

Stop: 3.00 V

Coupling Device:

CDN

Amplifier:

internal

Sweep: percentage increase

Start: 150.000 kHz

Stop: 230.000000 MHz

Perc: 1 %

Dwell: 1000 ms

Modulation: AM

AM Freq: 1000.0 Hz

AM Depth: 80.0 %

Pulse Freq: 2.0 Hz

Duty Cycle: 50.0 %

Linear

No. per Decade

Percent. Increase

ISO 11452

“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

Test Level:

Start: 3.00 V

Stop: 3.00 V

Coupling Device:

CDN

Amplifier:

internal

Sweep: percentage increase

Start: 150.000 kHz

Stop: 230.000000 MHz

Perc: 1 %

Dwell: 1000 ms

Modulation: AM

AM Freq: 1000.0 Hz

AM Depth: 80.0 %

Pulse Freq: 2.0 Hz

Duty Cycle: 50.0 %

Mod: AM

Mod. Freq.

Mod. Depth

Pulse Freq.

Duty Cycle

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 conservation 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

**Monitoring Setup**

**Digital inputs**

	Hi/Lo	Ask	Stop	Register
User Input 0:	Low	✓	✗	✗
User Input 1:	High	✗	✗	✗
User Input 2:	High	✗	✗	✗
User Input 3:	High	✗	✗	✗
Digital 1:	High	✗	✗	✗
Optical Input:	Low	✗	✗	✗

**Analog input**

Trigger < 3.00 or > 7.00 V ✓ ✗ ✗

**High/Low**  
**Ask User**  
**Stop Test**  
**Register**  
**Show Inputs**

There are several EUT monitoring ports:

- User port input 0 to 3: (4 bit TTL in)
- Digital 1: up to 24 V
- Optical input
- Analog input: 0-24 V

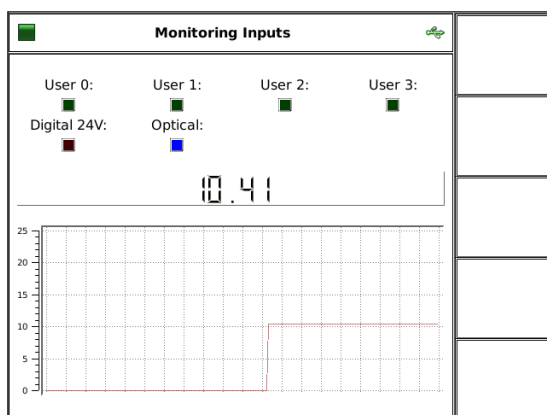
Each monitoring port can be individually configured. The switching condition can be set to high or low active using the softkey "HIGH/LOW". For analog input a window can be defined which can be used as a threshold or tolerance window.

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

■ Immunity Test calibration

Test Level:

Start: 3.00 V

Stop: 3.00 V

Coupling Device:

CDN

Amplifier:

internal

Sweep: percentage increase

Start: 150.000 kHz

Stop: 230.000000 MHz

Perc: 1 %

Dwell: 1000 ms

Modulation: AM

AM Freq: 1000.0 Hz

AM Depth: 80.0 %

Pulse Freq: 2.0 Hz

Duty Cycle: 50.0 %

System Cal.

Saturation Check

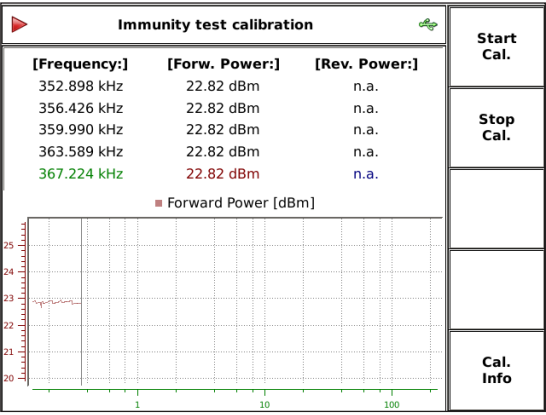
Probe Cal.

Two types of calibration can be performed:

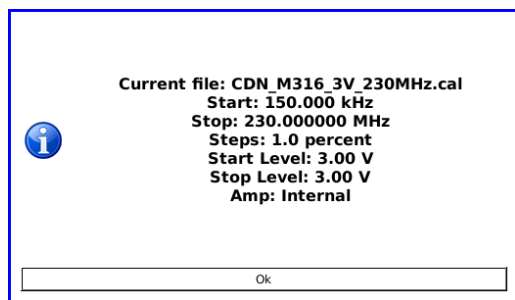
- system calibration for the entire setup
- probe calibration for the monitoring probe.

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

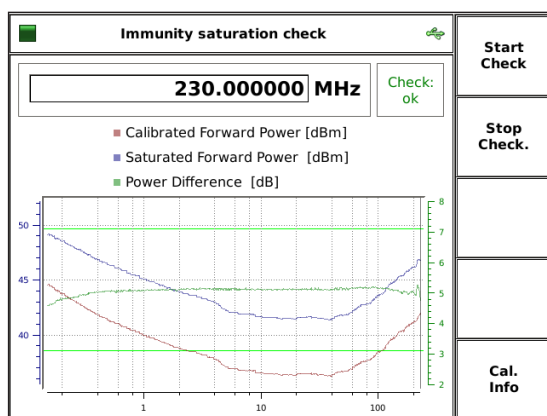






The softkey "CAL. INFO" provides the file name, start frequency, stop frequency, steps, start level, stop level and amplifier internal or external. An example is shown to the left.

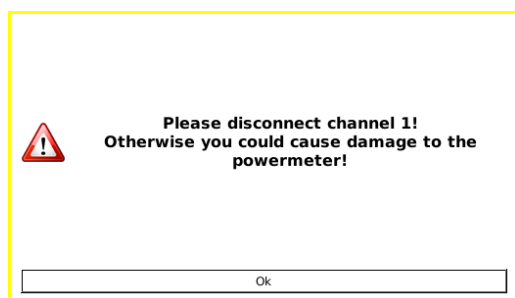
#### 4.5.3.2. Immunity menu —> Calibration —> Saturation check



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.

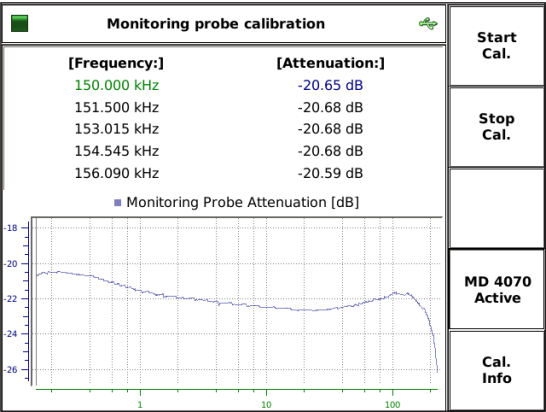
The result of the "SATURATION CHECK" is provided in a graph. The lower curve shows the calibrated forward power in red. The upper curve shows the increased forward power during the check. Both curves are related to the left axis. The green curve shows the check result (difference) and is related to the 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.

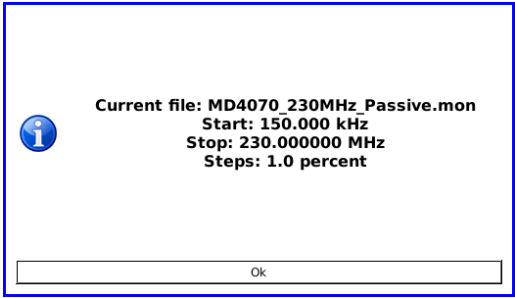
4.5.3.3. Immunity menu —> Calibration —> Probe calibration



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 “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.

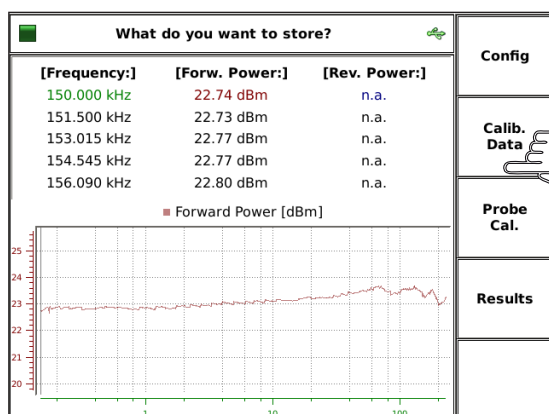


The softkey “CAL. INFO” provides the file name, start frequency, stop frequency and steps. An example is shown on the left side.

#### 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.

filename	size	date
1_bis_12MHz_ansteigend...	326	10/06/11 04:41
BCI_70u_100u.cal	412	08/06/11 21:30
BCI_80u_100u.cal	412	08/06/11 23:31
BCI_Ford_Level2_100m.cal	408	02/06/11 21:43
BCI_Ford_Level2_100u.cal	412	02/06/11 21:49
BCI_Ford_Level2_64.cal	412	02/06/11 21:39
BCI_Ford_Level2_80m_1...	408	02/06/11 21:46
BCI_Ford_Level2_80m_1...	414	02/06/11 22:00
CDN_M316_10V_80MHz.cal	7780	01/04/11 00:07
CDN_M316_10V_80MHz...	7712	01/04/11 00:08
CDN_M316_1V_230MHz.cal	8984	01/04/11 00:45
CDN_M316_3V_230MHz.cal	8984	01/04/11 02:29
CIP_9136_100mA_100k...	1690	01/04/11 02:26
Clamp_10V_230MHz.cal	8980	01/04/11 02:17
Schoellkopf.cal	410	02/05/11 10:40

comment: CDN\_M316\_3V\_230MHz

filename: CDN\_M316\_3V\_230MHz.cal Free: 49.273 MB

##### 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.

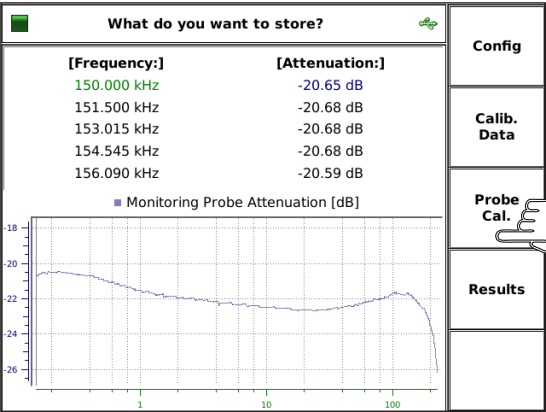


**Attention:** The recall of calibration data overwrites the parameters for test level and amplifier use (internal / external).

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.

The screenshot shows a menu titled "Load File". It contains a table with columns "filename", "size", and "date". The table lists four files: MD4070\_230MHz\_Passiv..., MD4070\_230MHz\_active..., MD4070\_mit\_falschem\_JL..., and rem\_temp.mon. Below the table is a "comment" field with the text "150kHz to 230MHz (Passive)". At the bottom, there is a "filename" field with "MD4070\_230MHz\_Passive.mon" and a "Free: 49.198 MB" indicator. A hand icon points to the "Load file" option in the right-hand menu.

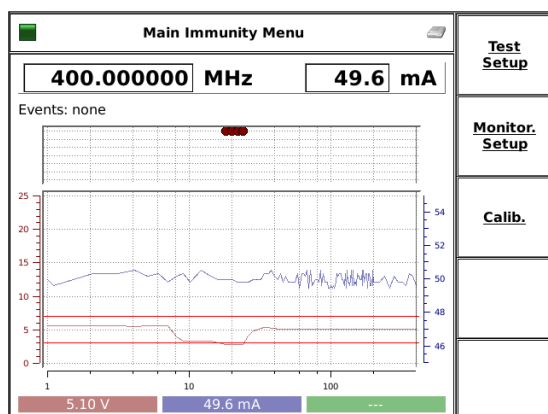
filename	size	date
MD4070_230MHz_Passiv...	6016	01/04/11 01:55
MD4070_230MHz_active....	6014	01/04/11 02:07
MD4070_mit_falschem_JL...	6056	01/04/11 00:26
rem_temp.mon	4510	01/04/11 00:03

**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

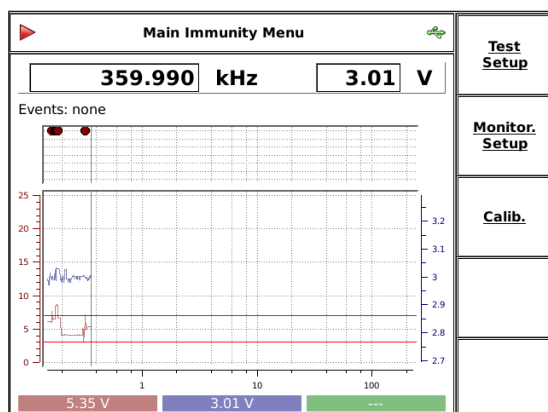


The softkey "RESULTS" shows the current test result which can be investigated by turning the rotary knob.

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.

#### 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.

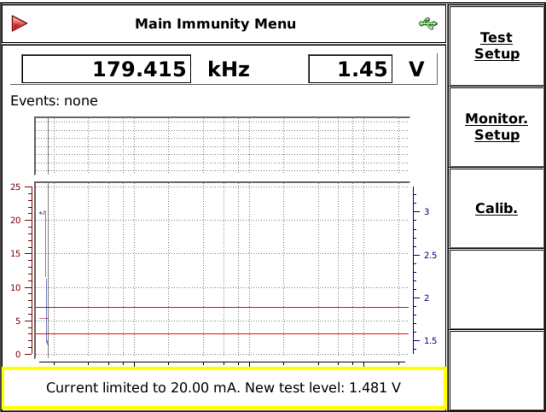
The internal control algorithm provides a maximum deviation of  $\pm 0.1$  dB to the used calibration values.

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



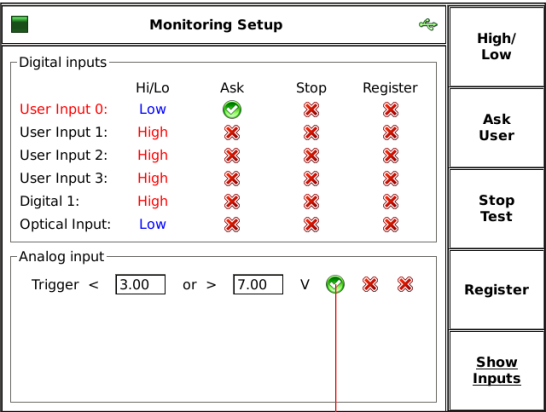
Testing with a monitoring probe requires a coupling device such as an EM clamp or CIP with selected “WITH PROBE” BCI testing requires “SUBSTITUTION WITH MONITORING DEVICE” or “CLOSED LOOP” for including a monitoring probe.

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

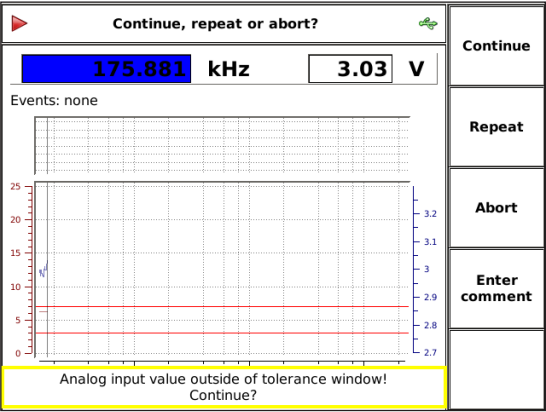
IEC/EN 61000-4-6 requires a limitation of the stress level if the requirements for the asymmetrical impedance cannot be fulfilled. A reduced stress level can be recognized as variance from the standard test level as shown in the blue curve. The test level (blue curve) is related to the right axis.

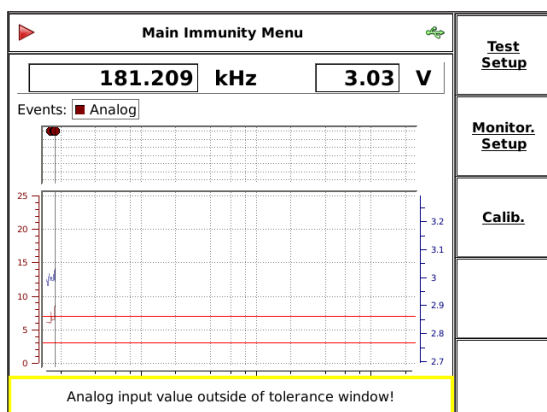
4.5.5.2. Immunity menu: Testing with EUT monitoring events



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).

- Example:
- If “ASK USER” is selected and an EUT monitoring event occurs:  
A message box and softkeys come up and the test is interrupted. An user action is required.  
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.

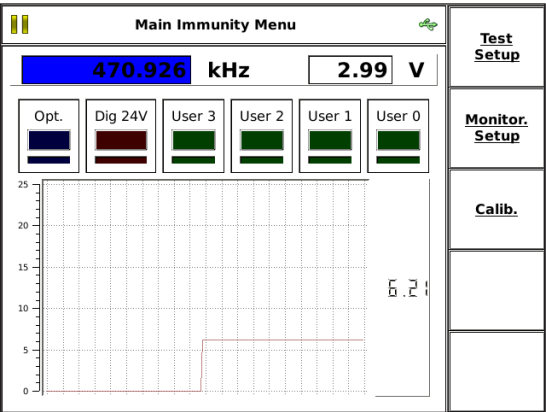
4.5.5.3. Immunity menu: Testing with manual change of frequency and level



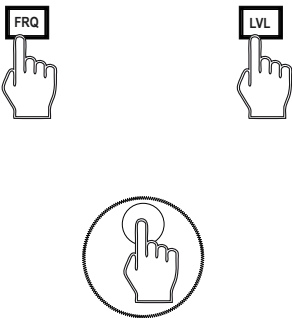
The key “RUN/STOP” allows the user to start the current test and the key “HOLD” interrupts the sweep and the display is changed as shown below:

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



Save File		
filename	size	date
111.res	369	01/04/11 00:08
CDN_M316_Test_131122....	34409	01/04/11 04:29
<div>comment</div> <div>CDN_M316, 3V, EUT xxx</div>		
filename		Free: 48.872 MB
CDN_M316_Test_131122.res		

Save file

Change comment

Change filename

USB Stick

Remove file

Load File		
filename	size	date
BCI_100mA_1_400M_ext...	646	01/04/11 03:13
CDN_3V_150k_230M_1pr...	608	01/04/11 00:34
<div>comment</div> <div>CDN_3V_150k_230M_1pro_1s</div>		
filename		Free: 48.992 MB
CDN_3V_150k_230M_1pro_1s.cfg		

Load file

USB Stick

Remove file

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.

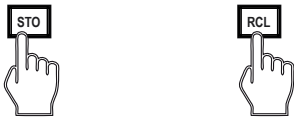
##### Recall

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.

Save File

filename	size	date
BCI_100mA_1_400M_ext...	646	01/04/11 03:13
CDN_3V_150k_230M_1pr...	608	01/04/11 00:34

comment BCI 100 mA, 1 to 400 MHz, external amp, ISO  
filename BCI\_100mA\_1\_400M\_ext\_amp.cfg Free: 49.027 MB

Save file

Change comment

Change filename

USB Stick

Remove file

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.

Load File

filename	size	date
BCI_100mA_1_400M_ext...	646	01/04/11 03:13
CDN_3V_150k_230M_1pr...	608	01/04/11 00:34

comment CDN\_3V\_150k\_230M\_1pro\_1s  
filename CDN\_3V\_150k\_230M\_1pro\_1s.cfg Free: 48.992 MB

Load file

USB Stick

Remove 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

**Main Generator Menu**

**100.000000 MHz -30.0 dBm**

Modulation: Off

AM Freq: 1000.0 Hz AM Depth: 80 %

Pulse Freq: 2.0 Hz Duty Cycle: 50 %

Wheel Step: 100 kHz, 1 MHz, 10 MHz

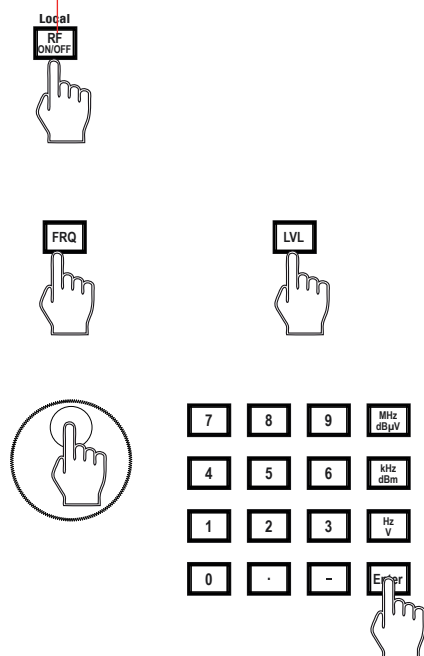
Amp: Off

Sweep: Off

RF ON/OFF, Freq, Level, Mod, Sweep, Amp Off

The "MAIN 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

RF Off

Modulation Setup

100.000000 MHz

-30.0 dBm

Modulation: AM

AM Freq: 1000.0 Hz AM Depth: 80 %

Pulse Freq: 2.0 Hz Duty Cycle: 50 %

Wheel Step

Amp

Sweep

100 kHz

Off

Sweep Mode:

1 MHz

--- dBm

Off

10 MHz

Mod: AM

Mod. Freq.

Mod. Depth

Pulse Freq.

Duty Cycle

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

Sweep settings menu		
<b>Modes</b> Sweep Mode: <b>Off</b> Step Mode: ---		<b>Freq. Sweep</b>
<b>Common</b> Dwell Time: 1000 ms Sweep: <b>single</b> Trigger: <b>internal</b>		<b>Level Sweep</b>
<b>Frequency Sweep</b> Start: 9.000 kHz Stop: 230.000000 MHz Step: 10.000 kHz		<b>Sweep Mode</b>
<b>Level Sweep</b> Start: -60.0 dBm Stop: 0.0 dBm Step: 0.1 dB		<b>Dwell Time</b>
		<b>more ...</b>

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

Extended sweep settings		
<b>Modes</b> Sweep Mode: <b>Off</b> Step Mode: ---		<b>single. Sweep</b>
<b>Common</b> Dwell Time: 1000 ms Sweep: <b>single</b> Trigger: <b>internal</b>		<b>int. Trigger</b>
<b>Frequency Sweep</b> Start: 9.000 kHz Stop: 230.000000 MHz Perc: 1.0 %		
<b>Level Sweep</b> Start: -60.0 dBm Stop: 0.0 dBm Step: 0.1 dB		

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

Main Generator Menu		
<b>100.000000 MHz -30.0 dBm</b>		<b>Freq</b>
<b>Modulation: Off</b> AM Freq: 1000.0 Hz AM Depth: 80 % Pulse Freq: 2.0 Hz Duty Cycle: 50 %		<b>Level</b>
<b>Wheel Step</b> 100 kHz 1 MHz 10 MHz		<b>Mod</b>
<b>Amp</b> <b>Off</b> --- dBm		<b>Sweep</b>
<b>Sweep</b> Sweep Mode: <b>Off</b>		<b>Amp Off</b>

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 (forward power) 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

[RF Off] Device Info		Update firmware
Device: Serial number: 16		
Software: Version: V2.09 Revision: ecb8ebbb Date: 2013-04-11 15:15:11 FPGA: 3		
Hardware: Amplifier: 72494 Directional coupler: 301 Powermeter: 370 Synthesizer: 347		

“DEVICE INFO” gives general information about serial numbers of the internal components as well as firm-ware versions.

4.7.1. Info —> Update firmware

[RF Off] Device Info		Update firmware
Device: Serial number: 16		
Software: Version: V2.09 Revision: ecb8ebbb Date: 2013-04-11 15:15:11 FPGA: 3		
Hardware: Amplifier: 72494 Directional coupler: 301 Powermeter: 370 Synthesizer: 347		

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/support/nsg-4070/firmware.php>

## 5. NSG 4070 CONTROL PROGRAM

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### 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/Win7
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/support/nsg-4070/NSG-4070-Control-Software.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.



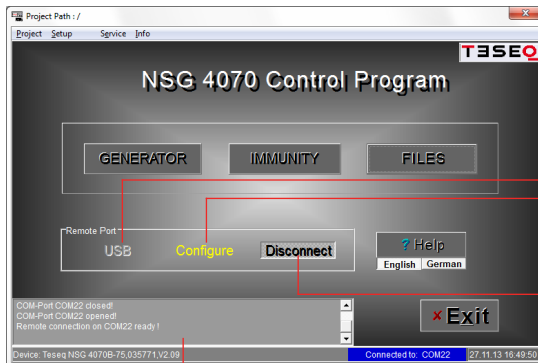
The screenshot shows the 'NSG 4070 Control Program' window. It has a menu bar with 'Project', 'Setup', 'Service', and 'Info'. The main area contains three buttons: 'GENERATOR', 'IMMUNITY', and 'FILES'. Below these are 'Remote Port' options: 'USB', 'Configure', and 'Disconnect'. There is also a 'Help' button with 'English' and 'German' sub-options, and an 'Exit' button. A status bar at the bottom shows 'Device: TeSEQ NSG 4070B-75.035771.V2.09' and 'Connected to: COM22'.

- 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 an USB interface.



■ The selection of the remote control port is made in this field. There are three possible interfaces available: Ethernet, USB or RS232.

■ The "CONFIGURE" button allows the configuration of the selected remote port.

■ The "CONNECT" button activates the remote control connection.

■ Status field of the remote connection

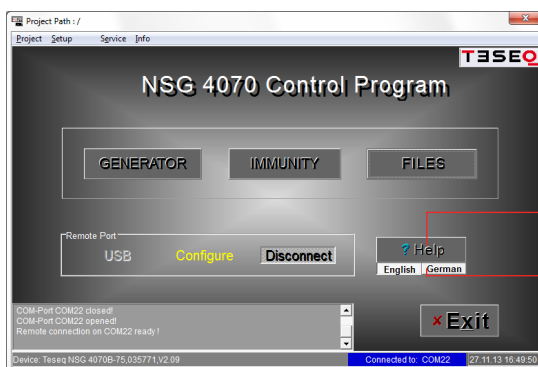


**Warning:** We strongly recommend consulting the responsible administrator before integrating the NSG 4070 in a company network.



**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.

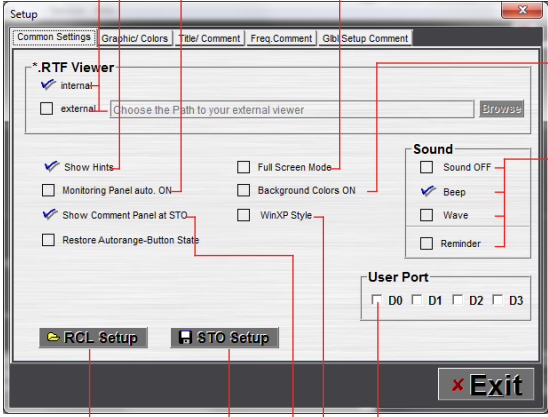
Context-sensitive help can be invoked in every window using the "F1" key of the PC keyboard.

■ Selects the language of the help function.

## 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.

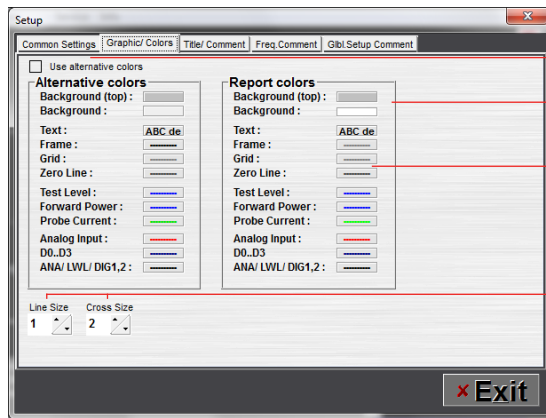


The screenshot shows the 'Setup' window with the following settings and callouts:

- \*.RTF Viewer:**
  - ☒ internal (Callout: 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.)
  - ☐ external (Callout: In some places, hints are displayed when the mouse is moved over the control elements. This feature can be deactivated here.)
- Choose the Path to your external viewer:** (Callout: 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.)
- Sound:**
  - ☐ Sound OFF (Callout: This mode uses the full screen. Changes apply after restarting the program.)
  - ☒ Beep (Callout: All program background colors can be deactivated and replaced with different shades of grey.)
  - ☐ Wave (Callout: A sound signal can be used to highlight the termination of a sweep as well as other program conditions.
  - ☐ Reminder (Callout: 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.)
- User Port:**
  - ☐ D0 ☐ D1 ☐ D2 ☐ D3 (Callout: The desired \*.wav files can be selected in the sound folder of the program or replaced by individual \*.wav files.)
- Background Colors:**
  - ☐ Background Colors ON (Callout: Switches the User Port outputs to TTL high. Settings described in Chapter 5.9.3.2 and 5.9.3.6 have the higher priority.)
  - ☐ WinXP Style (Callout: The keys will appear in the standard Windows XP style, unless "classic" is selected in Win XP. Changes apply after restarting the program.)
- Buttons:**
  - RCL Setup (Callout: 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.)
  - STO Setup (Callout: Stores and recalls setup files of this program)
  - Exit

### 5.6.2. Graphic Colors

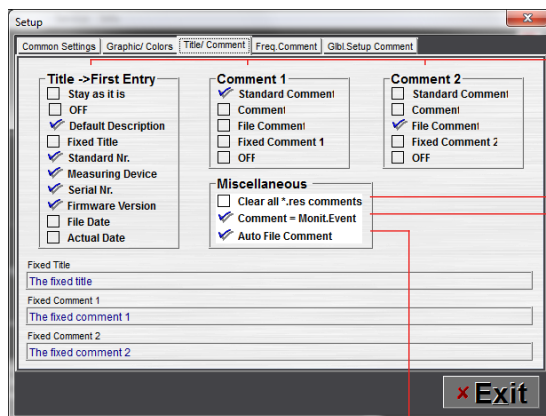
Under "GRAPHIC COLORS", it is possible to select an "ALTERNATIVE COLOR" palette for the measured value graphics and to change the respective colors. The report file graphics colors are defined in the "REPORT COLORS" area.



- 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.

Title ->First Entry

☐ Stay as it is

☐ OFF

☒ Default Description

☐ Fixed Title

☒ Standard Nr.

☒ Measuring Device

☒ Serial Nr.

☒ Firmware Version

☐ File Date

☐ Actual Date

The last test is loaded automatically, including its old "Title" comment string when the "IMMUNITY" window is opened. If "Stay as it is" is active, the first entry of the comment string remains unchanged.

Title comment line ON/OFF

This corresponds to the text in the first column of the "GLOBAL SETUP" menu

This is the text of the modifiable "FIXED TITLE" field.

This is the text of the modifiable field for the number of the standard which the test is being made in accordance with (in the "IMMUNITY" window).

Details of the measuring device.

File date and actual date

Comment 1

☒ Standard Comment

☐ Comment

☐ File Comment

☐ Fixed Comment 1

☐ OFF

A text string with the following information is generated from the test parameters:  
Frequency Step Width/Dwell Time/Coupling Device/Modulation

Two text strings from the comment string of the \*.res file (see chapter 5.9.4.5 Save)

This is the text of the modifiable "FIXED COMMENT 1" field.

"COMMENT 1" ON/OFF

Comment 2

☐ Standard Comment

☐ Comment

☒ File Comment

☐ Fixed Comment 2

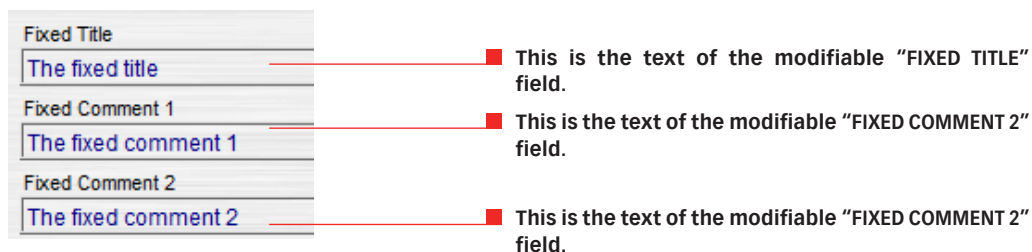
☐ OFF

A text string with the following information is generated from the test parameters:  
Frequency Step Width/Dwell Time/Coupling Device/Modulation

Two text strings from the comment string of the \*.res file (see chapter 5.9.4.5 Save)

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

"COMMENT 2" ON/OFF

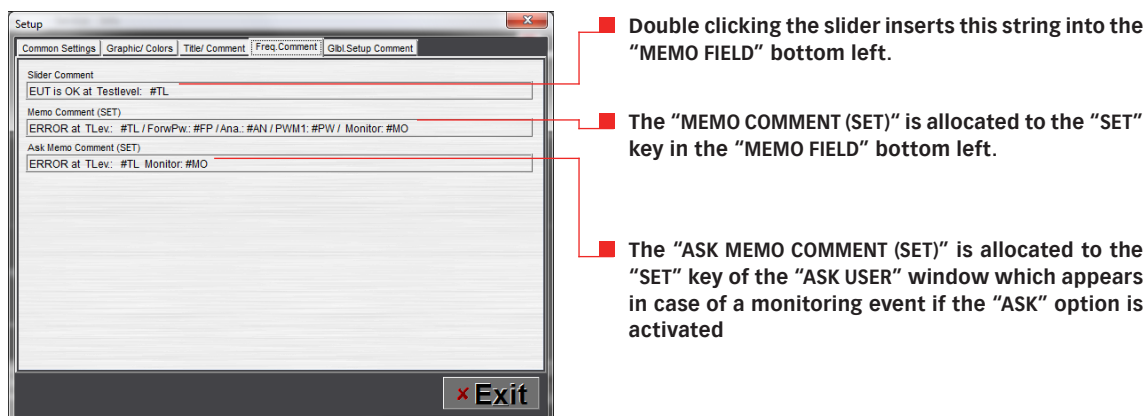


#### 5.6.4. Frequency comments

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:

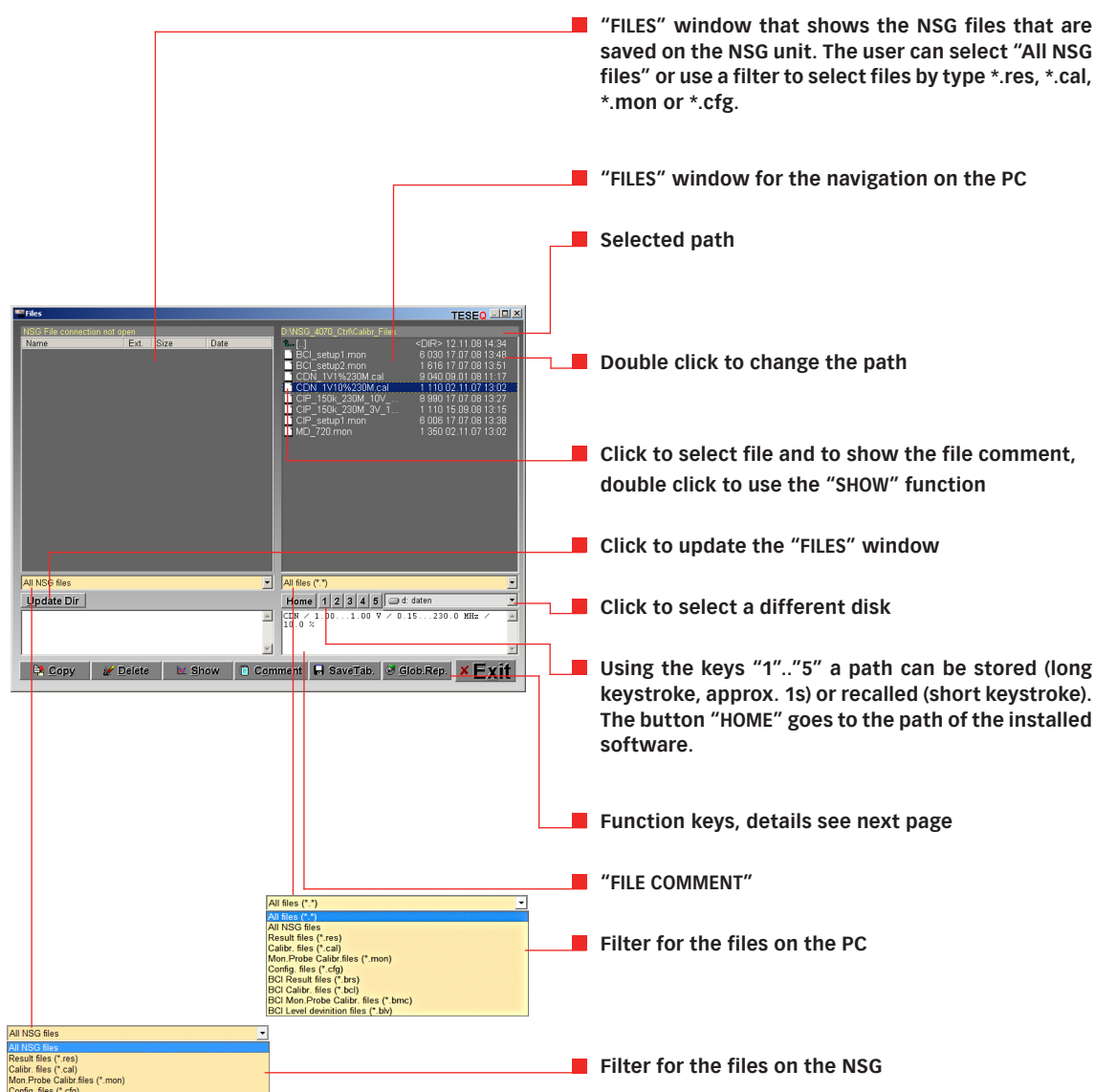
#FR	frequency
#TL	test level
#FP	forward power
#AN	analog input voltage (monitoring)
#PC	monitoring probe current
#PW	power meter ch 1, ch 2 or ch 3
#MO	monitoring event



## 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).



## 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.

Function keys: Copy F5, Delete F8, Show, Comment, SaveTab, Glob.Rep.

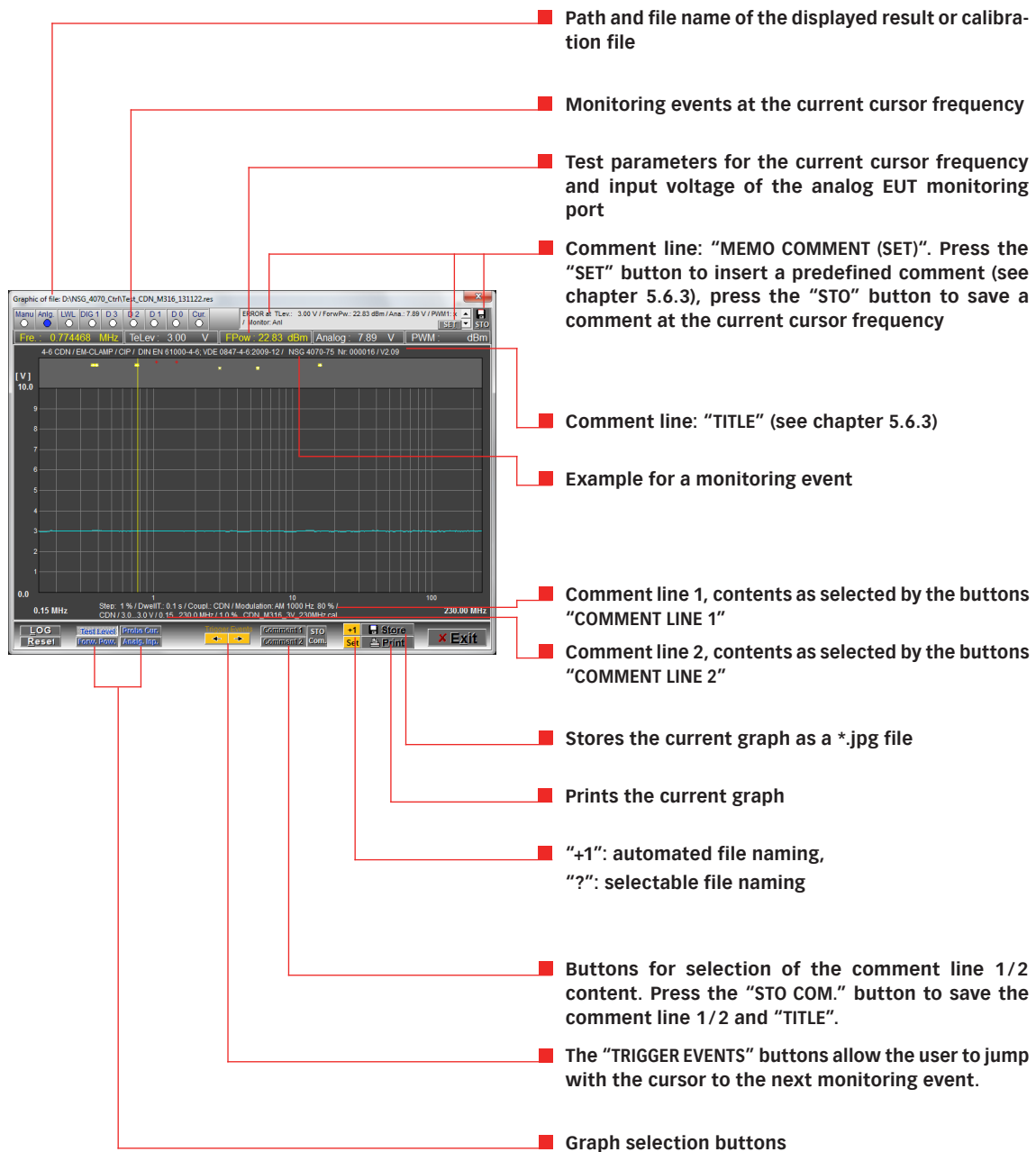
Frequency	Test Level	Forward Power	Probe Current	Ana.Mon.Input
0.150000	9.92 44.56	0.00 0.000	-100.00	x
0.157500	10.00 44.48	0.00 0.000	-100.00	x
0.165375	10.10 44.32	0.00 0.000	-100.00	x
0.173643	10.09 44.14	0.00 0.000	-100.00	x
0.182325	10.08 44.05	0.00 0.000	-100.00	x
0.191441	10.08 43.88	0.00 0.000	-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

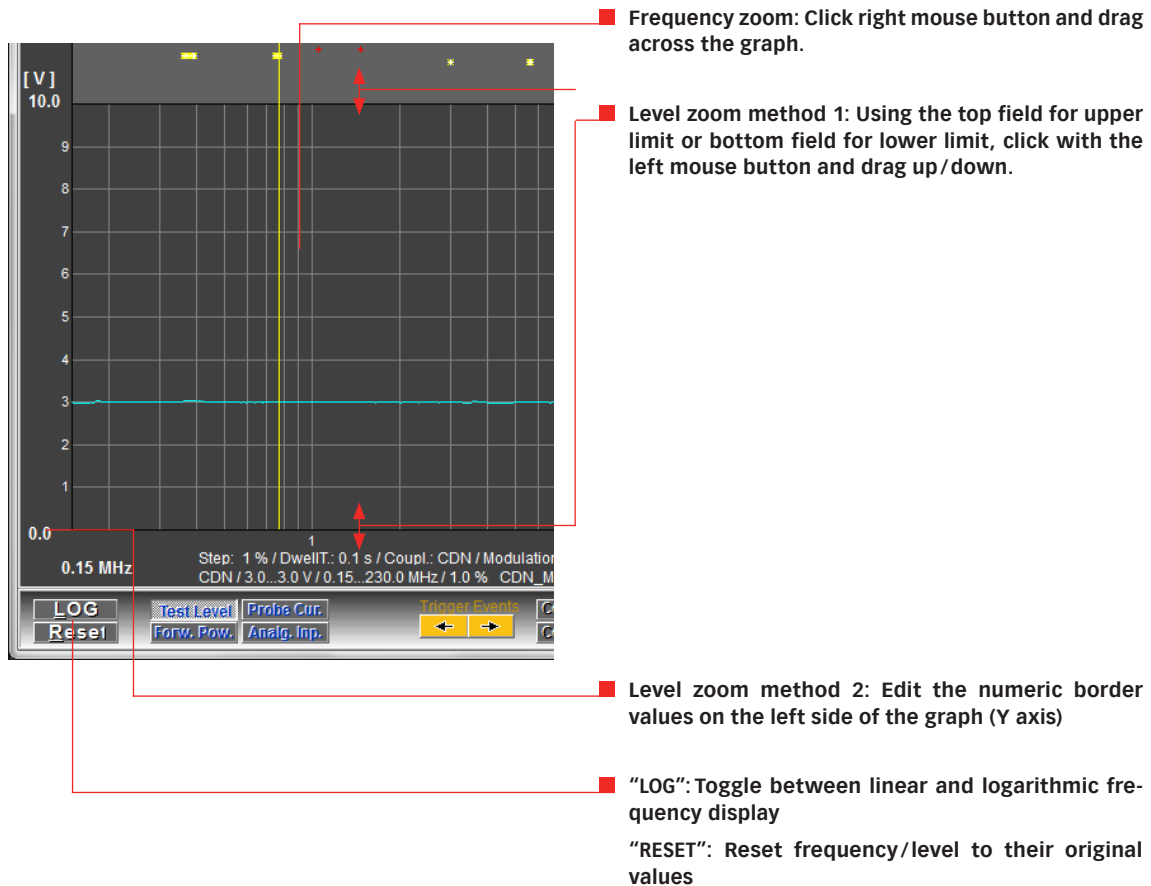
The "SHOW" window contains the graphical display of the test or calibration data. The following functions are available here:

- 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
  - Forward power and power meter measured value
  - Current of the monitoring probe





### 5.7.1.1. Graphical display



### 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 arrow keys (↑↓). Using the PC keyboard arrow keys (→←) allow to move with the step size of the test.

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"	<ul style="list-style-type: none"> <li>✓ Default Description</li> <li>✓ Standard Nr.</li> <li>✓ Measuring Device</li> <li>✓ Serial Nr.</li> <li>✓ Firmware Version</li> </ul>	4-6 CDN/EM clamp/CIP/ IEC 61000-4-6 (2006)/ NSG 4070-80 Nr: 000013/V1.28

**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)**

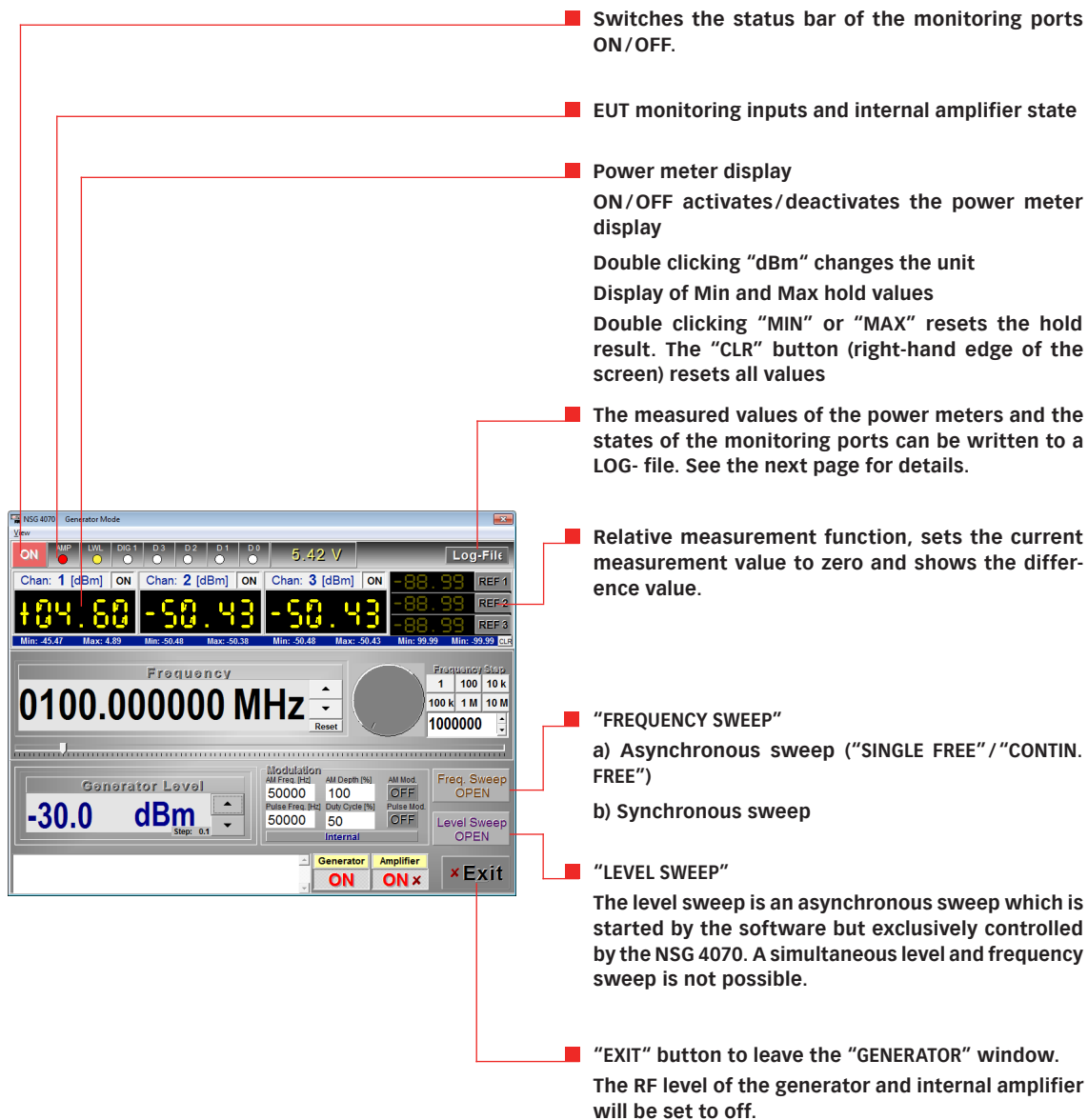
#### 5.7.1.4. Saving the graph

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
- Power meter channel 1 to 3
- Power amplifier (not for NSG 4070-0)
- EUT monitoring inputs



The screenshot shows the NSG 4070 Generator Mode window. It includes a status bar at the top with indicators for ON, LVL, DIG 1, D 3, D 2, D 1, and D 0, along with a voltage reading of 5.42 V and a Log-File button. Below this are three channels for power measurement: Chan: 1 [dBm] ON, Chan: 2 [dBm] ON, and Chan: 3 [dBm] ON. Each channel has a large digital display showing values like +104.60, -50.43, and -50.43. To the right of these are three reference levels (REF 1, REF 2, REF 3) all set to -88.99. Below the channel displays are minimum and maximum hold values for each channel. The main section of the window is for frequency control, showing 0100.000000 MHz with a frequency step selector (1, 100, 10 k, 100 k, 1 M, 10 M) and a frequency sweep button. Below the frequency section is the Generator Level control, showing -30.0 dBm with a step of 0.1. To the right of the level control are modulation settings (All Freq. Inc., AM Depth (%), AM Mod., Pulse Freq. (Hz), Duty Cycle (%), Pulse Mod.) and sweep controls (Freq. Sweep, Level Sweep). At the bottom are buttons for Generator (ON), Amplifier (ON x), and Exit (x Exit).

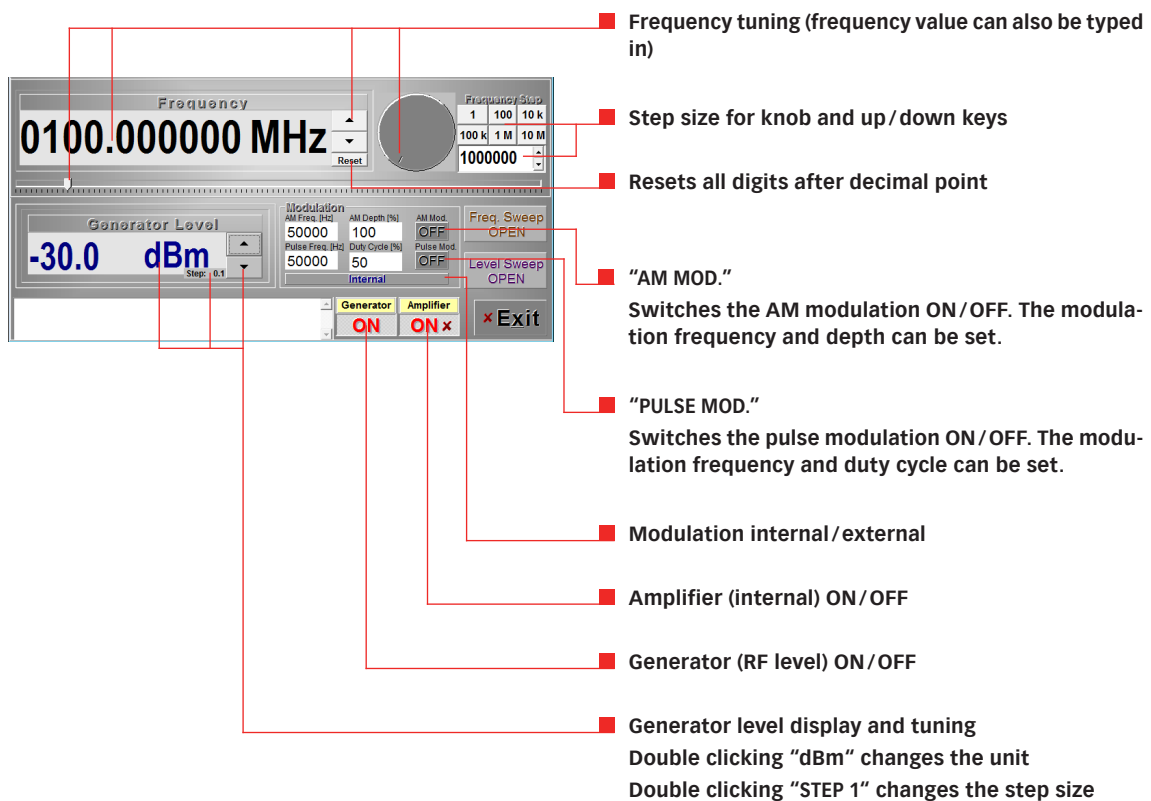
- Switches the status bar of the monitoring ports ON/OFF.
- EUT monitoring inputs and internal amplifier state
- Power meter display  
ON/OFF activates/deactivates the power meter display  
Double clicking "dBm" changes the unit  
Display of Min and Max hold values  
Double clicking "MIN" or "MAX" resets 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 difference value.
- "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)



### 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.

■ “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.

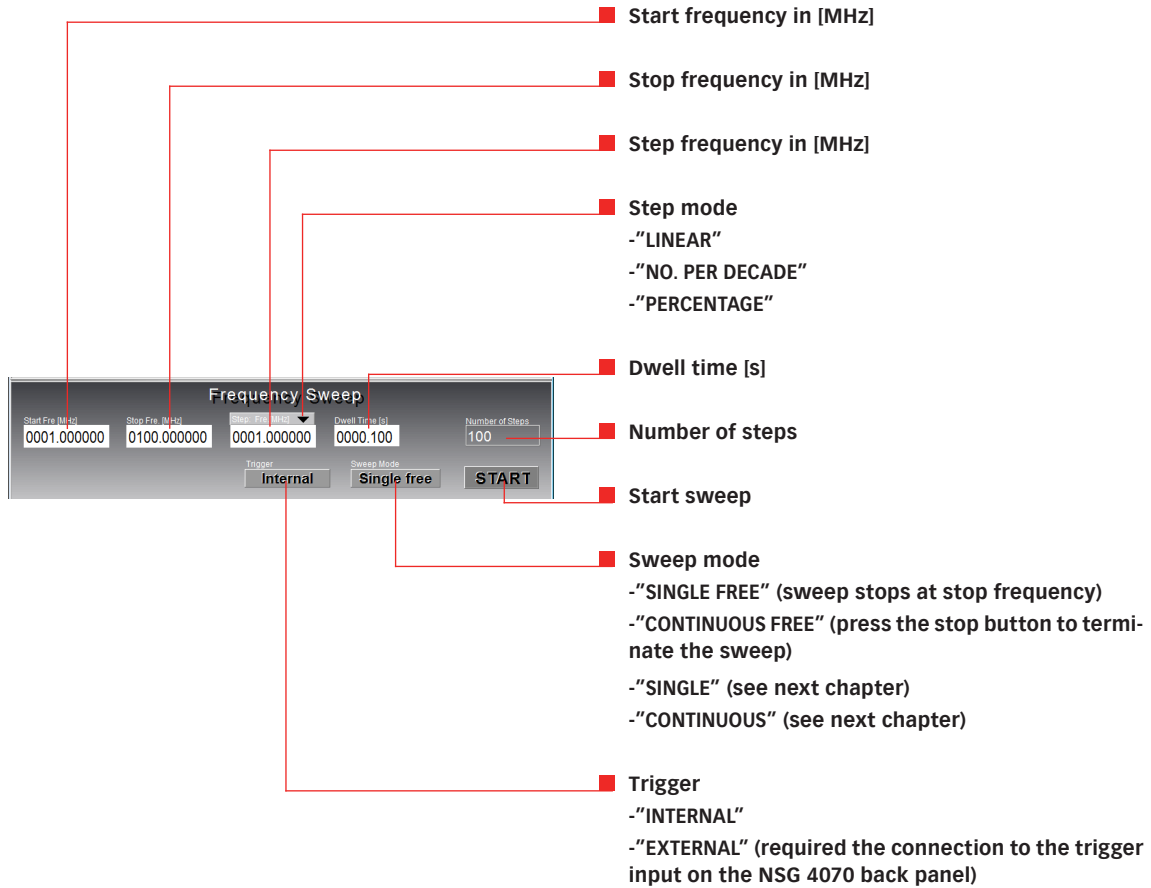
“INVERT LEVEL” inverts the measurement values (positive values to negative and neg. to pos.).

“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.

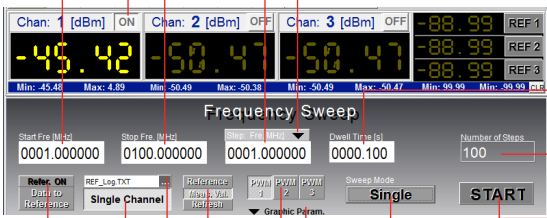


### 5.8.3. Generator window: Frequency synchronous sweep

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).



The screenshot shows the "Frequency Sweep" control window. It features three channels at the top: Chan: 1 [dBm] ON, Chan: 2 [dBm] OFF, and Chan: 3 [dBm] OFF. Each channel has a digital display showing a value (e.g., -45.42, -50.47, -50.47) and a reference value (e.g., -88.99, -88.99, -88.99). Below the channels are fields for Start Freq [MHz] (0001.000000), Stop Freq [MHz] (0100.000000), Step Freq [MHz] (0001.000000), and Dwell Time [s] (0000.100). There are also buttons for "Refer. ON", "Data to Reference", "Single Channel", "Reference", "Min:Val", "Ref:Val", and "Graphic Param.". At the bottom, there are buttons for "Sweep Mode" (Single) and "START".

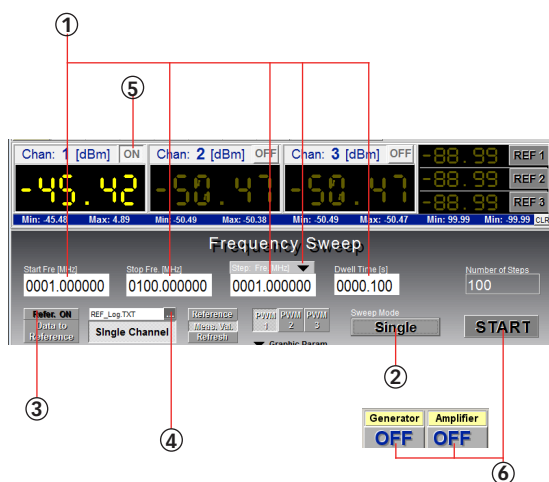
- Start frequency in [MHz]
- Selected power meter (up to 3 can be selected)
- Stop frequency in [MHz]
- Step frequency in [MHz]
- Step mode
  - "LINEAR"
  - "NO. PER DECADE"
  - "PERCENTAGE"
- Dwell time [s]
- Number of steps
- Start sweep
- Sweep mode
  - "SINGLE" / "CONTINUOUS" (press the "STOP" button 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:

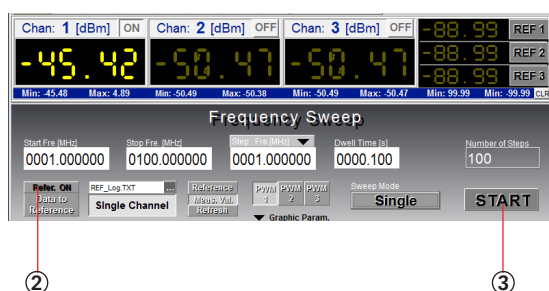


1. Define the sweep parameters.
2. Select "SINGLE" or "CONTINUOUS".
3. Set "REFER. OFF".
4. Define the name of the target file (for the measurement result and additional parameters regarding the "LOG-FILE" menu - see 5.8.1).
5. Activate the desired power meter channels
6. Set up the hardware (Connect 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

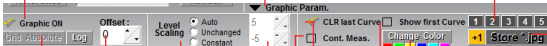
■ Graphical display  
 -"REFERENCE": Shows the reference data  
 -"MEAS. VAL.": Shows the measurement values  
 -"REFRESH": Shows the last measured curve in the full frequency range

■ "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

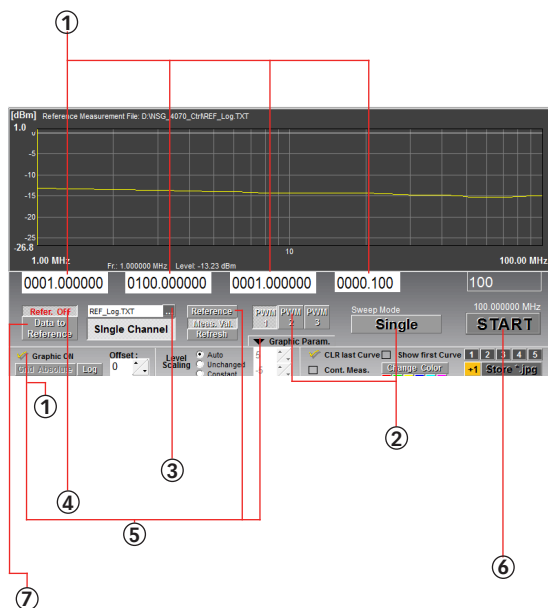
■ "DATA TO REFERENCE"  
 Sets the last measurement result to reference. Each power meter has own reference



The screenshot shows the 'Graphic Param.' dialog box with the following controls and their corresponding descriptions:

- Graphic ON**: Graphical display ON/OFF
- Offset**: Offset parameter for measuring data
- Level Scaling**: Level scaling at "REFR." / "MEAS. VAL." / "REFRESH"
  - "AUTO" (auto scaling)
  - "UNCHANGED"
  - "CONSTANT" (allows the user to set parameters for the level axis)
- CLR last Curve**: Clears the last curve at measurement start
- Cont. Meas.**: Uncheck this to terminate a continuous measurement at stop frequency
- Change color**: "CHANGE COLOR" button (valid for next curve and useful for "CONTINUOUS" mode)
- +1**: Saves the graph as \*.jpg.
  - "+1": Names file automatically
  - "?": Browse button for jpg-file selection
- Store .jpg**: Saves the graph as \*.jpg.
- Grid**: 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:

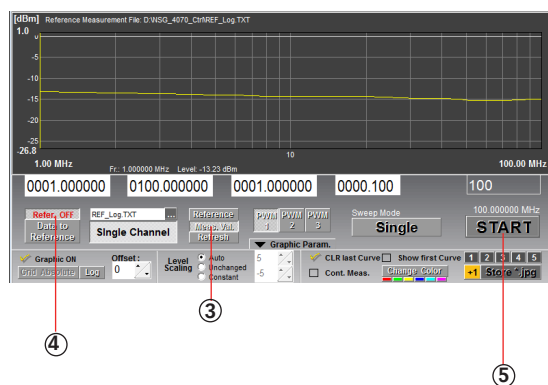


1. Define the sweep parameters (Switch off the graphical display for better orientation).
2. Select "SINGLE" or "CONTINUOUS" and choose one of the power meter channels.
3. Define the name of the target file (for the measurement result and additional parameters regarding the "LOG-FILE" menu - see 5.8.1).
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".

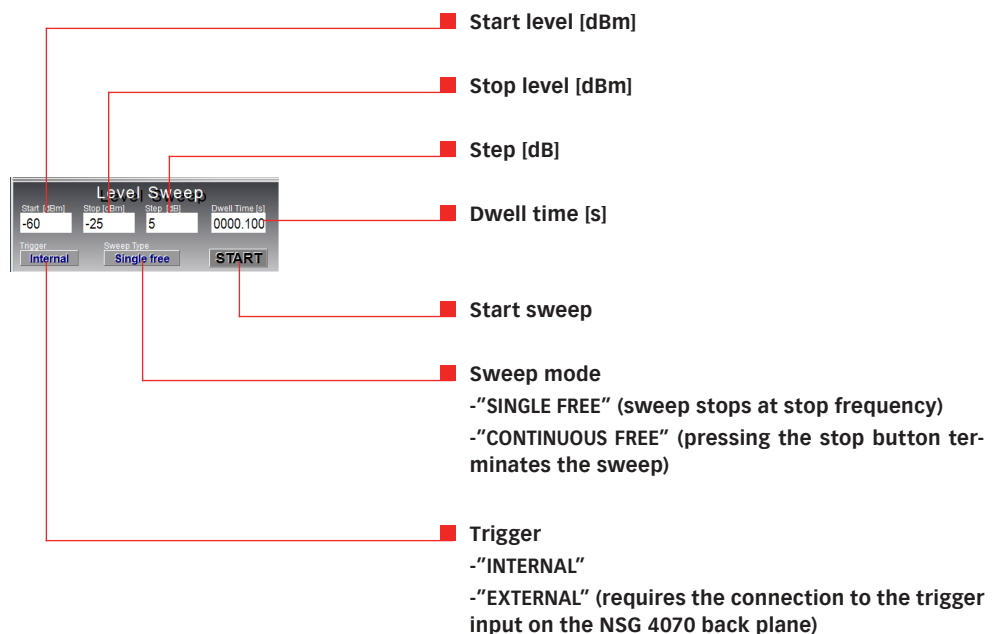


Each power meter channel can have an individual reference. Using "DATA TO REFERENCE" will store the measurement values as a reference for the current activated power meter channel.

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 calibration (as rem\_temp.cal) and monitoring probe calibration data (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.

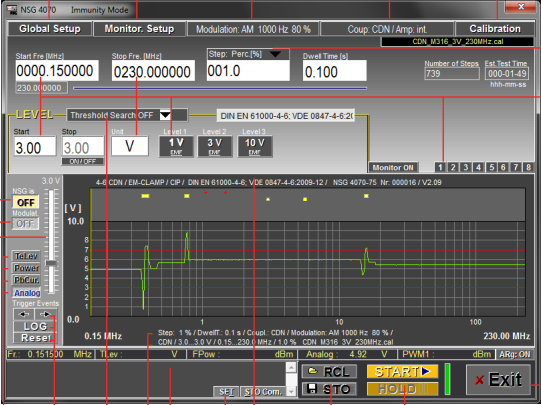
The same procedure is executed when loading a saved test with "RCL".

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

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The screenshot shows the 'Global Setup' window of the Teseo NSG 4070 Immunity Monitor. The interface includes several sections: 'Global Setup' at the top with fields for Start Freq, Stop Freq, Step, and Dwell Time; 'Monitor Setup' with a 'LEVEL' section for setting voltage levels (3.00V, 1V, 3V, 10V) and a 'Threshold Search' menu; a central graph area showing a waveform; and a bottom section with various buttons like 'RCL', 'START', 'HOLD', 'STO', and 'EXIT'. Red callout lines connect specific UI elements to descriptive text blocks on the right.

- 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 options of defining a maximum frequency step size (ISO-steps, see also chapter 4.5.1.4.1) and testing on specific frequencies (Frequency table, see chapter 5.9.4.4).
- 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.
- Arrow keys move the cursor to the monitoring events and "LOG"/"LIN" buttons switch the X axis to linear or logarithm scaling. The "RESET" button turns the display back to the original scaling.
- Buttons to show different result graphs
- Slider and buttons for manual change of the test level (see chapter 5.9.4.2)

5.9.3.1. Global setup

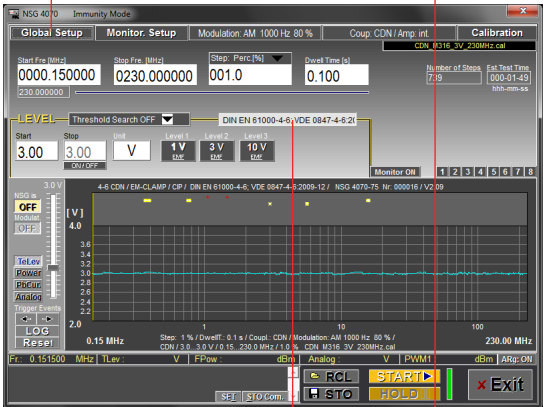
- Different operating modes can be selected in the "GLOBAL SETUP" menu. Depending on the operating mode the input elements of the "IMMUNITY" window and some menus will be modified.

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

Cancel	
4-6 CDN / EM-CLAMP / CIP	DIN EN 61000-4-6
4-6 Level Sweep (absolute) [V]	
4-6 Level Sweep Spot Values [V]	
BCI measurements	ISO 11452-4
BCI Level Sweep (absolute) [mA]	
BCI Level Sweep Spot Values [mA]	
Show test set-up pictures	

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. (See next page for example)



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).

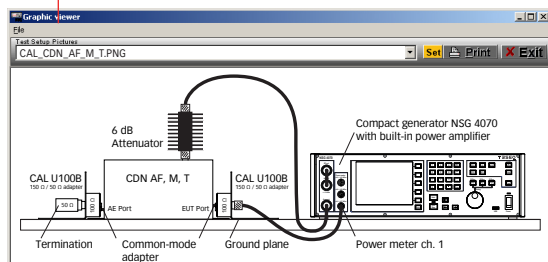
- The text for the second column will be copied to the "STANDARD NR." field of the "IMMUNITY" window and can be edited there.

DIN EN 61000-4-6; VDE 0847-4-6:2011

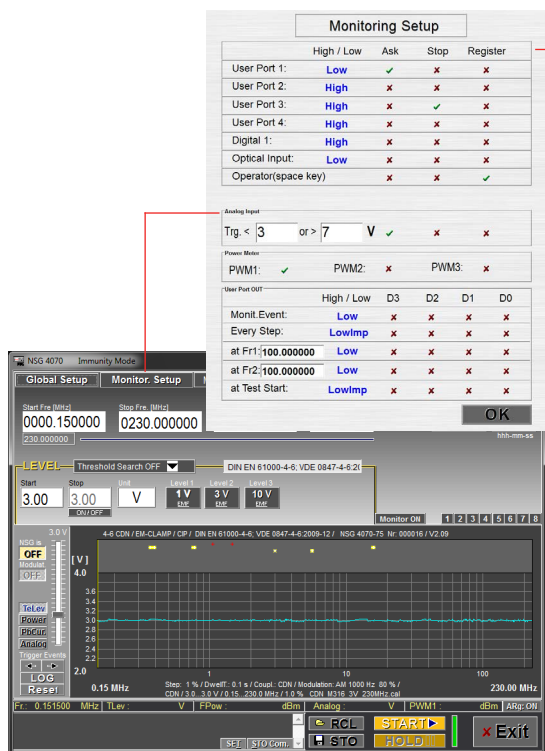


Cancel	
4-6 CDN / EM-CLAMP / CIP	DIN EN 61000-4-6
4-6 Level Sweep (absolute) [V]	
4-6 Level Sweep Spot Values [V]	
BCI measurements	ISO 11452-4
BCI Level Sweep (absolute) [mA]	
BCI Level Sweep Spot Values [mA]	
Show test set-up pictures	

■ “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. Selected ports are displayed as \* or + in the graphic when the High / Low condition is satisfied.

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.

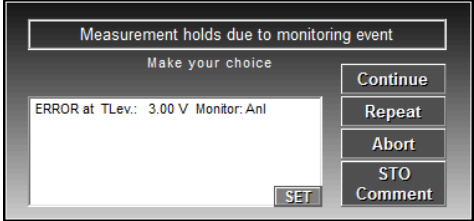
The lower part of the window allows the activation of user port outputs at specific test frequencies or monitoring events. Switching the user port outputs at a certain test frequency causes the RF output and amplifier to be switched off for 150 ms in order to use this function for switching between two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

Additionally there is a second frequency line that allows an independent controlling of an active Monitoring Probe like e.g. the MD 4070.

■ EUT monitoring port input and PC space key

■ Clicking to change the active state "LOW" / "HIGH"

■ In case of an event the test interrupts, a window appears and proceeds depending on user decision.



■ Stops test in case of an event.

■ Registers the monitor event in the measurement results.

■ X not in use  
✓ selected

■ 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 FR1" / "AT FR2": Provides selected outputs on a specified frequency (input in MHz). Use D3 low for switching the MD 4070 in the passive mode and use D2 low for switching SW 4070 to path 1.

"AT TEST START": Provides a selected output on test start.

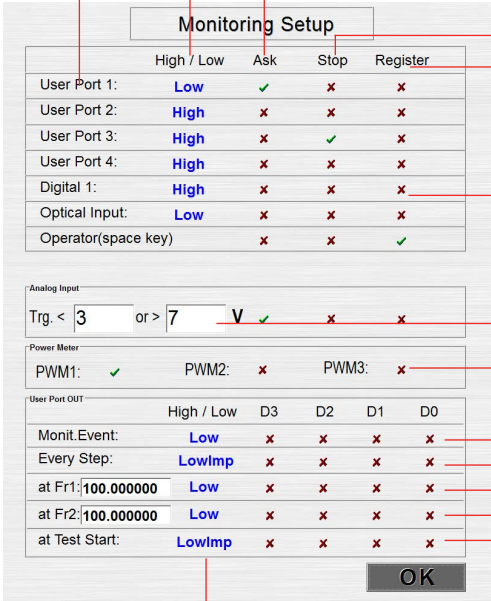
■ Active state

"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



	High / Low	Ask	Stop	Register
User Port 1:	Low	✓	✗	✗
User Port 2:	High	✗	✗	✗
User Port 3:	High	✗	✓	✗
User Port 4:	High	✗	✗	✗
Digital 1:	High	✗	✗	✗
Optical Input:	Low	✗	✗	✗
Operator(space key)		✗	✗	✓

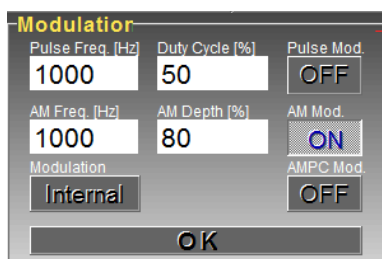
Analog Input  
Trg. < 3 or > 7 V ✓ ✗ ✗

Power Meter  
PWM1: ✓ PWM2: ✗ PWM3: ✗

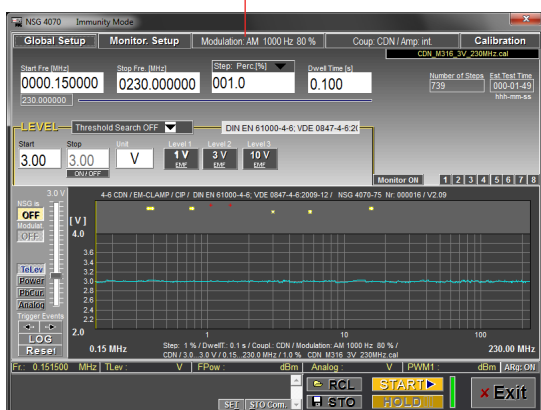
	High / Low	D3	D2	D1	D0
Monit.Event:	Low	✗	✗	✗	✗
Every Step:	LowImp	✗	✗	✗	✗
at Fr1: 100.000000	Low	✗	✗	✗	✗
at Fr2: 100.000000	Low	✗	✗	✗	✗
at Test Start:	LowImp	✗	✗	✗	✗

OK

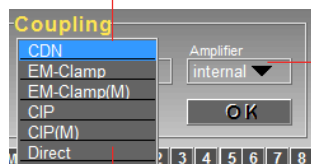
### 5.9.3.3. Modulation setup



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

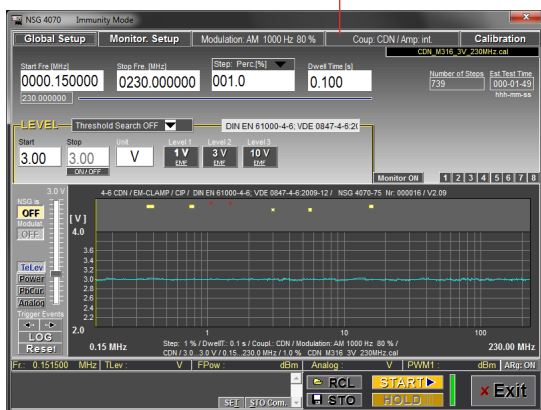


### 5.9.3.4. Coupling setup (only in the mode IEC 61000-4-6)



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 or external power amplifier. "MIXED" allows to use the internal power amplifier with an external directional coupler. For the NSG 4070-0 is only the external power amplifier available.



### 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 or external power amplifier. "MIXED" allows to use the internal power amplifier with an external directional coupler. For the NSG 4070-0 is only the external power amplifier available.

Power limitation factor as described in ISO 11452-4 for the Closed loop method. The default value is 4. (See chapter 8.3.7 for more information.)

### 5.9.3.6. BCI level editor (only BCI)

In addition to constant or slope test levels this mode provides also the definition of an arbitrary test level curve. However, automatic susceptibility level search and test level interpolation are not available in this mode, i.e. the test has to be performed on the calibrated level.

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".

A level definition file can be activated in the field "BCI LEVEL CURVE". An activation of a level definition file causes also 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.

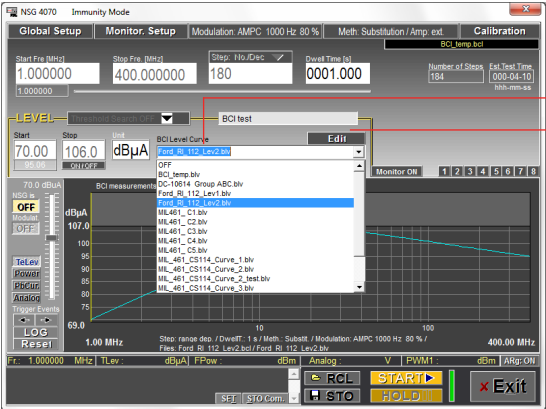
After selection of a test level curve a system calibration is possible. The calibration as well as the test are done in sections according to the frequency ranges of the test level curve. After the calibration the individual sections are put together and displayed as one curve. The calibration file should 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.

In conjunction with the selection of a calibration file the corresponding level definition file is loaded as well and thus enables an immediate start of the immunity test.

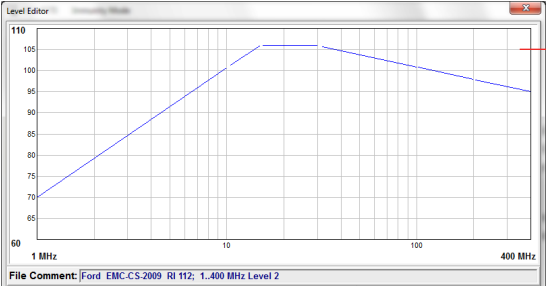
Similar to the calibration, the test is also done in sections. The final test result will be displayed in one curve. If a monitoring probe is used the probe current will be displayed instead of the test level. Depending on the test set-up deviations between the calculated test level and the measured probe current may occur, especially for higher frequencies.

The BCI test results should be stored with the extension \*. brs. In addition to the test results this file type includes the calibration (BCI\_temp.cal and rem\_temp.mon) and level definition (BCI\_tmp.blv) information which are automatically recalled in conjunction with loading the result file. This allows an immediate restart of the test. Note that this file type as well as the calibration data is not compatible to the NSG 4070 files.

Depending on the K-factor settings which are usually set according to the requirements of the test standard, a limitation of the test level may occur. This limitation will be indicated as monitoring events in the graph (green crosses) as well as in the Monitoring Panel by the Cur. LED.



- A level definition file can be activated in the field "BCI LEVEL CURVE". Choosing the item "OFF" from the list returns to the previous test mode.
- The definition of an arbitrary test level curve can be done using the corresponding editor "EDIT" key.

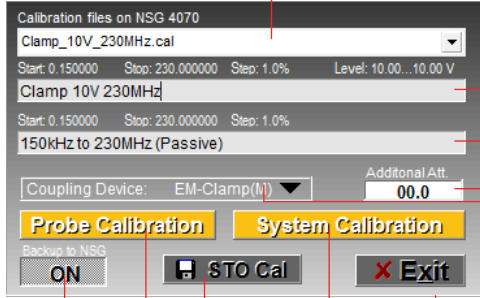


- Start frequency<sup>1</sup> in MHz
- Start level<sup>1,2</sup> in mA/dBμA, click to change
- Stop level<sup>1,2</sup> in mA/dBμA, click to change
- Step modus<sup>3</sup>, click to change
- Frequency step or number of steps<sup>1</sup>
- Stop frequency<sup>1</sup> in MHz
- High/Low level<sup>3</sup> on User-Port-D2 for SW 4070
- High/Low level<sup>3</sup> on User-Port-D3 for MD 4070
- Power amplifier<sup>3</sup> int./ext./mixed
- Scaling of the curve

Start Freq	Start Level	Stop Level	Step Kind	Freq. Step	Stop Freq	SV	MP	Auto
[MHz]	[dBμA]	[dBμA]		[MHz]	[MHz]	[D2]	[D3]	Mode
1.000000	64.0	94.6	No per Dec.	10	10.000000	L	L	int.
10.000000	95.3	100.0	No per Dec.	100	15.000000	L	L	int.
15.000000	100.0	100.0	No per Dec.	100	30.000000	L	L	int.
30.000000	99.7	94.9	No per Dec.	45	100.000000	L	L	int.
100.000000	94.8	91.9	No per Dec.	450	200.000000	H	L	int.
200.000000	91.8	89.0	No per Dec.	100	400.000000	H	L	ext.

- Buttons to store/recall/print and escape of the curve or the editor
- "DEL.LINE F5" deletes the selected line.
- "INS.LINE F4" inserts a line.
- "LIN/LOG" changes the scaling of the x axis from linear to logarithm and back.
- Fields to define the curve parameter

<sup>1</sup> Double click in the field of the table row for parameter input.  
<sup>2</sup> Double click on the field of the table head for changing.  
<sup>3</sup> Double click on the field of the table row for changing.



- 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)")
- This Parameter allows to use an additional attenuator to protect power meter 1 against levels above the maximum power of this channel. Enter 10 for an attenuator of 10 dB. Enter -9.5 for doing a "SYSTEM CALIBRATION" regarding IEC/EN 61000-4-6 in a 50 Ω system (Current injection probe in a 50 Ω jig)..
- 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.

**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.

5.9.3.8. Step parameter, threshold search and EUT monitor

Step: Fre [MHz]

Linear

No. per Decade

Percentage

ISO Step

Frequency Table

The "STEP WIDTH" menu includes the options of defining the frequency increase and step size. (ISO-steps, see also chapter 4.5.1.4.1). Frequency tables can be chosen for testing on separate frequencies. The file has to be in ASCII format and must contain a column which contains the frequency in MHz.

For example:

```
0.15
5
20
80
```

It tests at 150 kHz, 5 MHz, 20 MHz and 80 MHz.

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:

- reducing the test level using the current step size until the monitoring event vanishes
- further reduction of the test level by 6 dB
- increase of the test level until the monitoring event occurs again

Threshold Search OFF

Threshold Search UP

Threshold Search DOWN

Threshold Search MIL461E

Setup

Start Level [V] Delay [ms]

0.5 0

Level Step Size Monitor Delay [ms]

0.5 V 0

Exit

"START LEVEL" sets the start level and "DELAY" allows a dwell time before switching on the first search level of the "THRESHOLD SEARCH UP". The level step can be set with the parameter "LEVEL STEP SIZE". "%" is related to the maximum test level of the test and "V" allows an increase in fixed steps. A "MONITOR DELAY" time > 0 ms delays the scanning of the digital/analog monitoring ports, that happens at the end of every test step.

Manu. Anlg. LVL DIG1 D3 D2 D1 D0 Cur. 2.55 V

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".



**Attention:**

**Remove the connection to the power meter channel 1 after calibration. Caused by the modulation the increased test levels could damage the power meter.**

#### Pre-conditions for testing according IEC / EN 61000-4-6

- "GLOBAL SETUP": select "4-6 CDN/EM\_CLAMP/CIP"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation (e.g. AM, 1 kHz, 80%)
- "COUPLING SETUP": select coupling device (CDN, EM clamp, CIP or direct) and amplifier
- "CALIBRATION SETUP": load system calibration (\*.cal) 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 for testing according IEC/EN 61000-4-6 with monitoring probe

- "GLOBAL SETUP": select 4-6 CDN/EM\_CLAMP/CIP
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation (e.g. AM, 1 kHz, 80%)
- "COUPLING SETUP": select coupling device (CDN, EM clamp, CIP or direct) and amplifier
- "CALIBRATION SETUP": load system calibration (\*.cal) from NSG
- "CALIBRATION SETUP": load probe calibration (\*.mon) from NSG
- Set test parameters: start/stop frequency, step size, dwell time, start/stop level
- Set "THRESHOLD SEARCH OFF"
- Set "MONITOR ON" (optional)

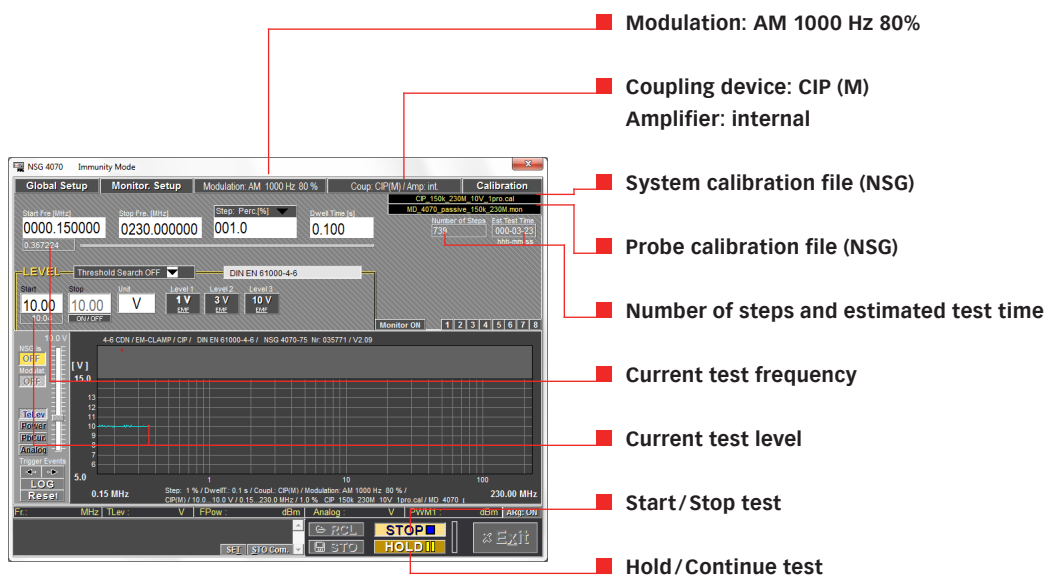
#### Pre-conditions for Automotive BCI testing (without "BCI level curve")

- "GLOBAL SETUP": select "BCI MEASUREMENTS"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation (e.g. AM PC, 1 kHz, 80%)
- "COUPLING SETUP": select BCI method, power limitation factor and amplifier
- "CALIBRATION SETUP": load system calibration (\*.cal) from NSG
- "CALIBRATION SETUP": load probe calibration (\*.mon) 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)

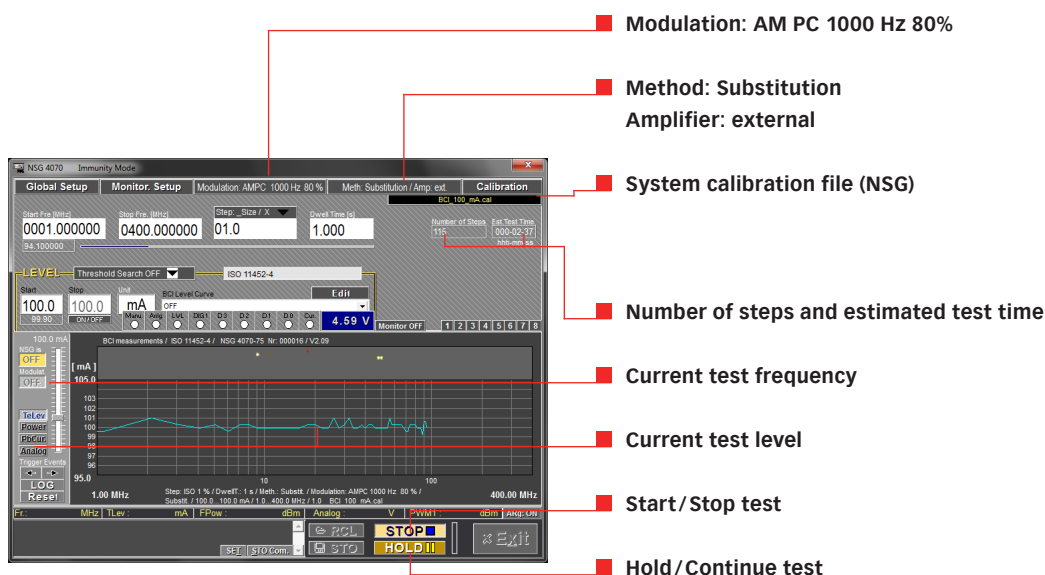
**Pre-conditions for Automotive BCI testing with "BCI level curve"**

- "GLOBAL SETUP": select "BCI MEASUREMENTS"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation (e.g. AM PC, 1 kHz, 80%)
- "COUPLING SETUP": select BCI method, power limitation factor and amplifier
- "CALIBRATION SETUP": load \*.bcl calibration file from the PC (The file includes "BCI LEVEL CURVE". This file is automatically loaded as BCI\_tem.blv. It includes the switching points of SW 4070, MD 4070 and amplifier. See also chapter 5.9.3.6.)
- "CALIBRATION SETUP": load probe calibration file (\*.bmc) from NSG (only for substitution (M) and Closed loop method)
- Set "MONITOR ON" (optional)

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



## Example of BCI testing with Substitution method



**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. A double click on the slider inserts a string with the current test level into the “MEMO FIELD”, see also chapter 5.6.4.. There is a continuous query and display of the monitoring ports when the NSG 4070 output is activated.



#### Attention:

All changes in the frequency specific comments apply only to the currently displayed data set and should be explicitly stored using “STO” in order to keep the changes.

- 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. Alternative the PC keyboard's Page ↑ or Page ↓ keys can be used. Any changes needs to be confirmed with "Enter".
- Left clicking in the graphic sets the measuring cursor to any desired test frequency and the associated test results are displayed in the monitoring panel and in the numeric fields underneath the graphic
- It is possible to input a single line comment for the selected cursor frequency in the first two lines of the "MEMO FIELD" on the bottom left. Double click in this field deletes all old comments. The "SET" key inserts a comment defined in the setup window (see comment strings ) and the key "STO COM" stores the comment.
- The test frequency can be changed by using the "TRIGGER EVENTS" button. Alternative the PC keyboard's Arrow ← or Arrow → keys can be used to change the frequency. PC keyboard's Arrow ↓ or Arrow ↑ keys can be used to reach the trigger events..



#### 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 (e.g. AM, 1 kHz, 80%)
- "COUPLING SETUP": select coupling device (CDN, EM clamp, CIP or direct) and amplifier
- "CALIBRATION SETUP": load system calibration (\*.cal) 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 LEVEL SWEEP (ABSOLUTE) [V]" or "4-6 LEVEL SWEEP SPOT VALUES [V]"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation (e.g. AM, 1 kHz, 80%)
- "COUPLING SETUP": select coupling device and amplifier
- "CALIBRATION SETUP": load system calibration (\*.cal) from NSG
- "CALIBRATION SETUP": load probe calibration (\*.mon) 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. Caused by the modulation the increased test levels could damage the power meter.**

#### Pre-conditions (BCI measurements without "BCI level curve"):

- "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 (e.g. AMPC, 1 kHz, 80%)
- "COUPLING SETUP": select BCI method, power limitation factor and amplifier
- "CALIBRATION SETUP": load system calibration (\*.cal) from NSG
- "CALIBRATION SETUP": load probe calibration (\*.mon) 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)

Cancel	
4-6 CDN / EM-CLAMP / CIP	DIN EN 61000-4-6
4-6 Level Sweep (absolute) [V]	
4-6 Level Sweep Spot Values [V]	
BCI measurements	ISO 11452-4
BCI Level Sweep (absolute) [mA]	
BCI Level Sweep Spot Values [mA]	
Show test set-up pictures	

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

Example of setting the “LEVEL SWEEP ABSOLUTE VALUES”

LEVEL Threshold Search OFF

Start [V] 1.00 Stop [V] 3.00 Step [V] 1.00

Current Level V

■ 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”

LEVEL Threshold Search OFF

	1..3	4..6	7..9	10..12	13..15	16..18	19..21	
1	2.0	3.2						Current Level [V] Monitor
1.2	2.5							
1.5	3							

■ The spot values of the test level can be set directly.  
The test will be performed at every test frequency with the levels and sequence 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 (e.g. AM, 1 kHz, 80%)
- "COUPLING SETUP": select coupling device (CDN, EM clamp, CIP or direct) and amplifier
- "CALIBRATION SETUP": load system calibration (\*.cal) 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 (e.g. AM, 1 kHz, 80%)
- "COUPLING SETUP": select coupling device and amplifier
- "CALIBRATION SETUP": load system calibration (\*.cal) from NSG
- "CALIBRATION SETUP": load probe calibration (\*.mon) from NSG
- Set test parameters: start/stop frequency, step size, dwell time, start/stop level
- Set "THRESHOLD SEARCH ON"
- Set "MONITOR ON" (optional)



##### Attention:

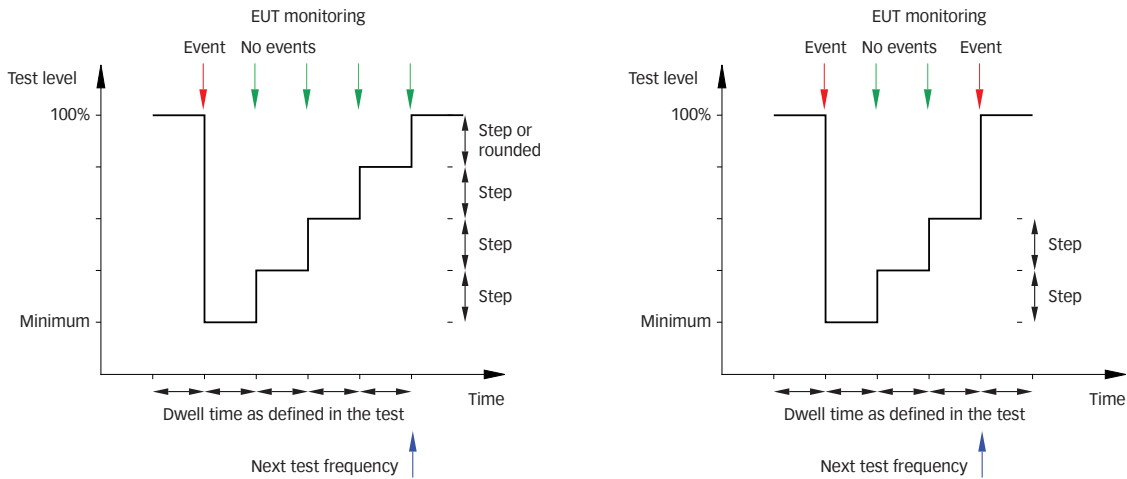
**Disconnect the power meter channel 1 for performing tests in the calibration setup with amplitude modulation and above 18 V EMF stress level.**

##### Pre-conditions (BCI measurements without "BCI level curve"):

- "GLOBAL SETUP": select "BCI MEASUREMENTS"
- "MONITORING SETUP": select EUT monitoring ports and functions
- "MODULATION SETUP": select modulation (e.g. AMPC, 1 kHz, 80%)
- "COUPLING SETUP": select BCI method, power limitation factor and amplifier
- "CALIBRATION SETUP": load system calibration (\*.cal) from NSG
- "CALIBRATION SETUP": load probe calibration (\*.mon) 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”**

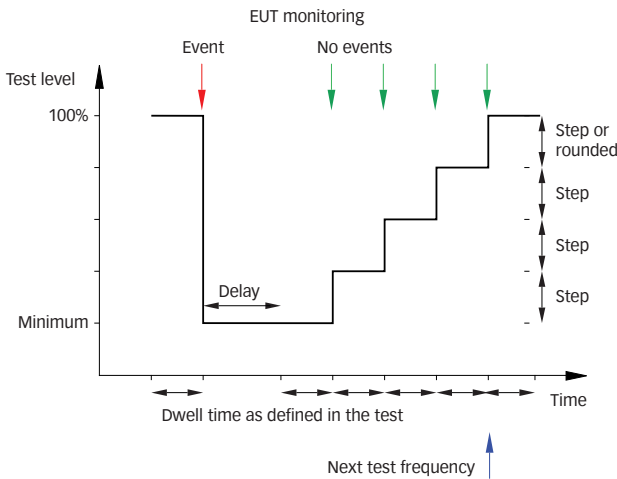
In case of a monitoring event the test level will be reduced to a definable minimum level (“THRESHOLD SEARCH SETUP”) and then increased up to the occurrence of a new monitoring event using a definable step width (“THRESHOLD SEARCH SETUP”). This susceptibility threshold will be documented in conjunction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

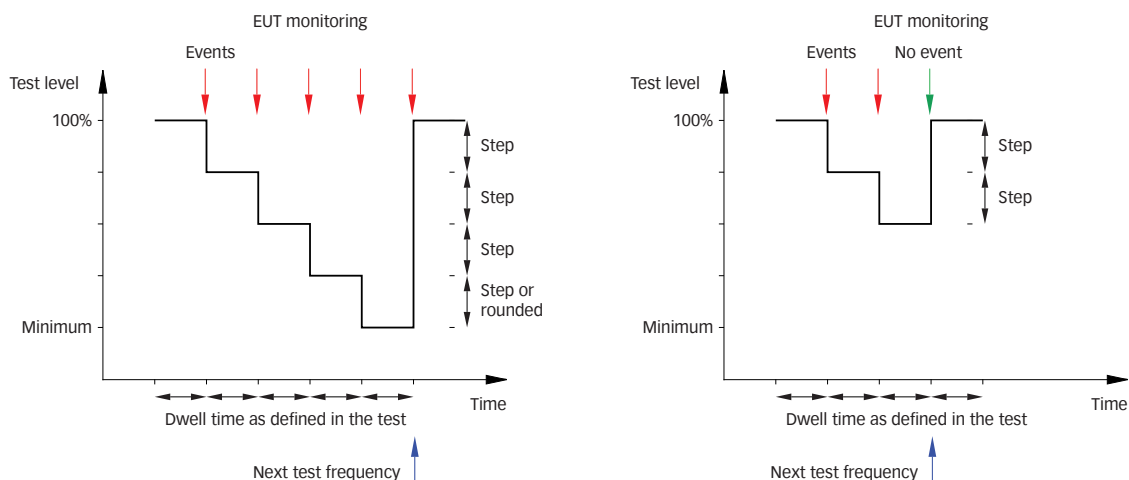


Figure 7: Example “THRESHOLD SEARCH DOWN”

### “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

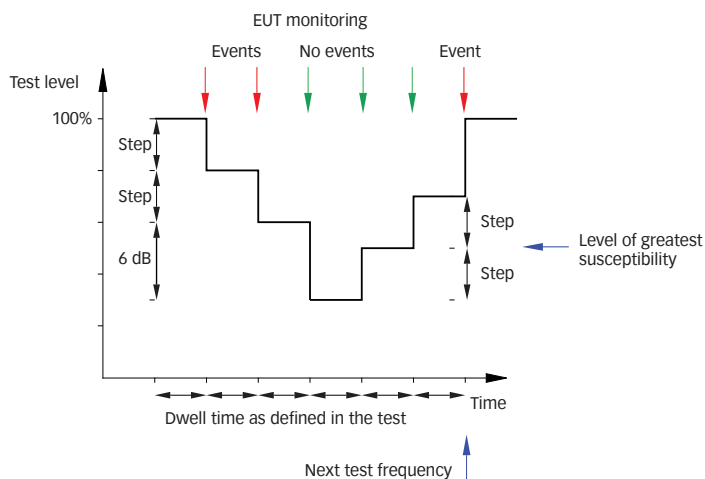


Figure 8: Example “THRESHOLD SEARCH MIL 461”

### 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. Testing on separate frequencies (frequency table)

It might be helpful to reduce the sweep limits or doing test on separate frequencies for the further EUT investigation. Sweeps can be reduced by changing the start- and stop frequencies. The function frequency table allows tests on frequencies given in a table. This table has to be a simple ASCII file with one frequency per line. An example is available in the \Example Files directory in FreTab1.TXT. The frequencies have to be in MHz.

Example:

```
0.15
5
20
80
```

It will be tested at 150 kHz, 5 MHz, 20 MHz and 80 MHz.

Existing results in a \*.res file format can be converted in an ASCII file via the function "SAVE TAB." of the "FILE" menu (chapter 5.7). A common available Editor program allows to modify the file for having just the test frequencies in a column.

Testing can be started with the "START" button. In the frequency table mode a calibration of the NSG 4070 is not possible. Instead of that an already existing calibration file with similar frequency steps has to be chosen. A calibration file with a small step size provides more accuracy.

#### 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 (e.g. AM, 1 kHz, 80%)
- "COUPLING SETUP": select coupling device (CDN, EM clamp, CIP or direct) and amplifier
- "CALIBRATION SETUP": load system calibration (\*.cal) from NSG
- Set test parameters: start/stop frequency, for step size use the desired frequency table, 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 (e.g. AM, 1 kHz, 80%)
- "COUPLING SETUP": select coupling device and amplifier
- "CALIBRATION SETUP": load system calibration (\*.cal) from NSG
- "CALIBRATION SETUP": load probe calibration (\*.mon) from NSG
- Set test parameters: start/stop frequency, for step size use the desired frequency table, 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. Caused by the modulation the increased test levels could damage the power meter.**

**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 (e.g. AMPC, 1 kHz, 80%)
- "COUPLING SETUP": select BCI method, power limitation factor and amplifier
- "CALIBRATION SETUP": load system calibration (\*.cal) from NSG
- "CALIBRATION SETUP": load probe calibration (\*.mon) from NSG (only for substitution (M) and Closed loop method)
- Set test parameters: start/stop frequency, for step size use the desired frequency table, dwell time, start/stop level
- Set "THRESHOLD SEARCH OFF"
- Set "MONITOR ON" (optional)

### 5.9.4.6. 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.

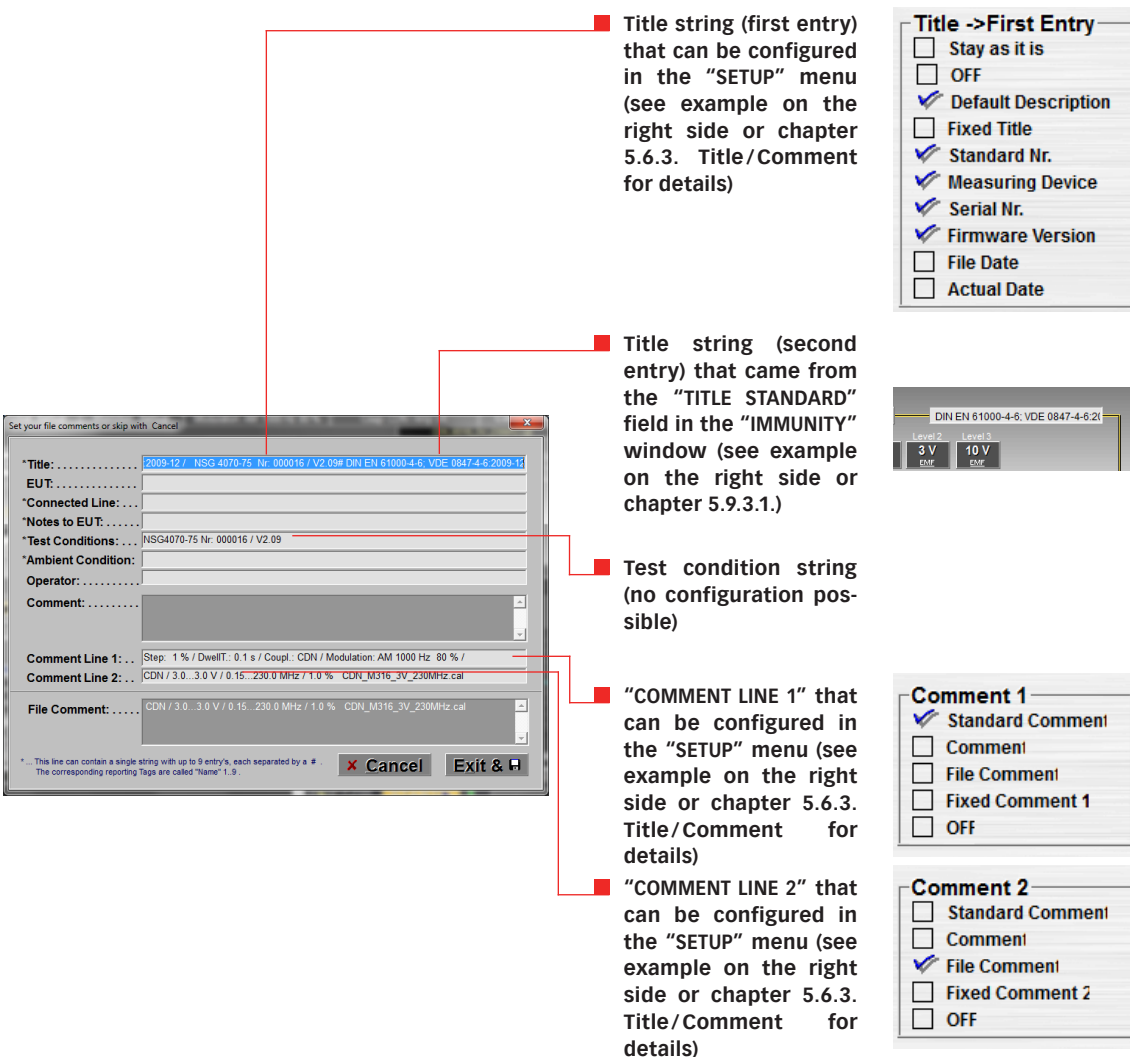
This window enables the modification of all the comments stored in a result file. The program automatically generates 5 comment entries for each immunity test. These are:

- 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:



The screenshot shows the 'COMMENT' window with the following fields and annotations:

- 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)

**Configuration Panels:**

**Title -> First Entry**

- ☐ Stay as it is
- ☐ OFF
- ☒ Default Description
- ☐ Fixed Title
- ☒ Standard Nr.
- ☒ Measuring Device
- ☒ Serial Nr.
- ☒ Firmware Version
- ☐ File Date
- ☐ Actual Date

**Comment 1**

- ☒ Standard Comment
- ☐ Comment
- ☐ File Comment
- ☐ Fixed Comment 1
- ☐ OFF

**Comment 2**

- ☐ Standard Comment
- ☐ Comment
- ☒ File Comment
- ☐ Fixed Comment 2
- ☐ OFF

**Example Data from Screenshot:**

\*Title: 2009-12 / NSG 4070-75 Nr. 000016 / V2.09# DIN EN 61000-4-6, VDE 0847-4-6 2009-12

EUT: ...

\*Connected Line: ...

\*Notes to EUT: ...

\*Test Conditions: NSG4070-75 Nr. 000016 / V2.09

\*Ambient Condition: ...

Operator: ...

Comment: ...

Comment Line 1: Step: 1 % / DwellT.: 0.1 s / Coupl.: CDN / Modulation: AM 1000 Hz 80 % /

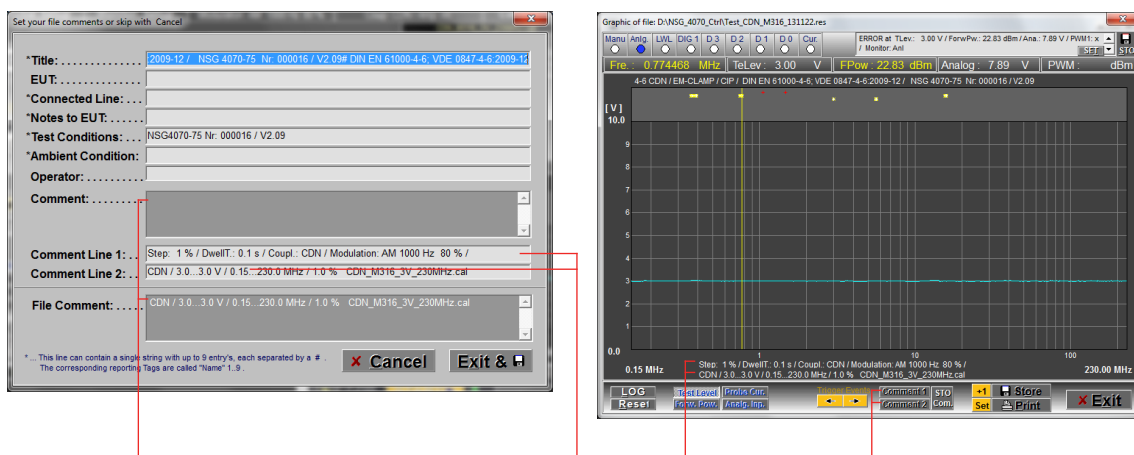
Comment Line 2: CDN / 3.0 ... 3.0 V / 0.15 ... 230.0 MHz / 1.0 % - CDN\_M316\_3V\_230MHz.cal

File Comment: ...

\* This line can contain a single string with up to 9 entries, each separated by a # .  
The corresponding reporting tags are called "Name" 1..9

Buttons: Cancel, Exit & [Icon]

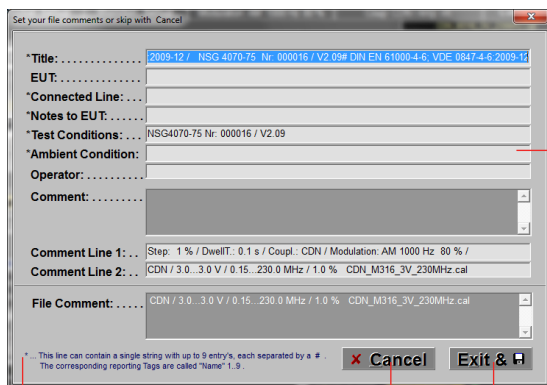
### Example 2 of the "COMMENT" window:



■ 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.

### 5.9.4.7. 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.

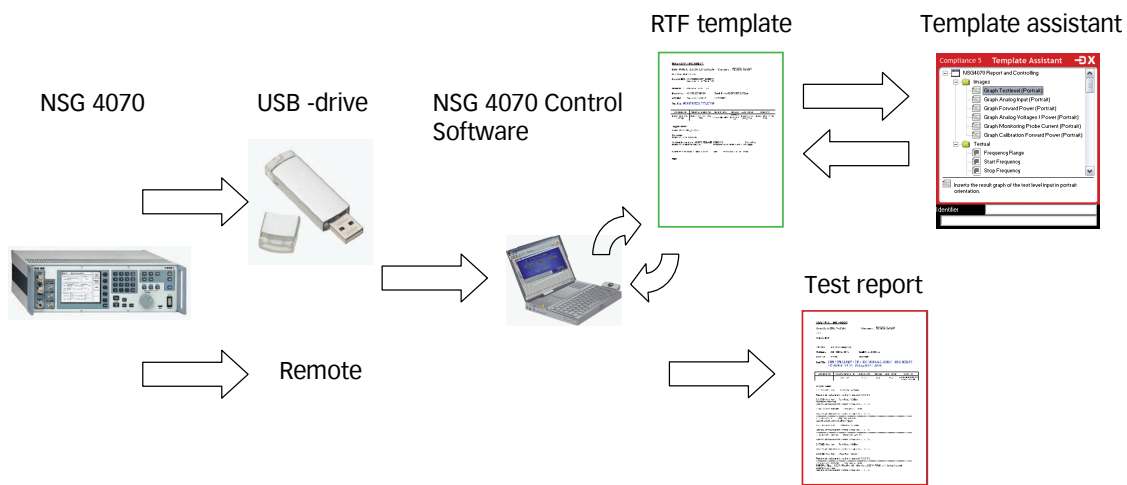


Figure 9: Simplified illustration of the test report generation

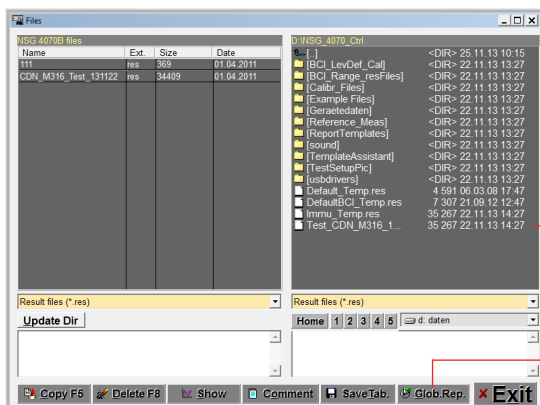


#### Attention:

**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.**

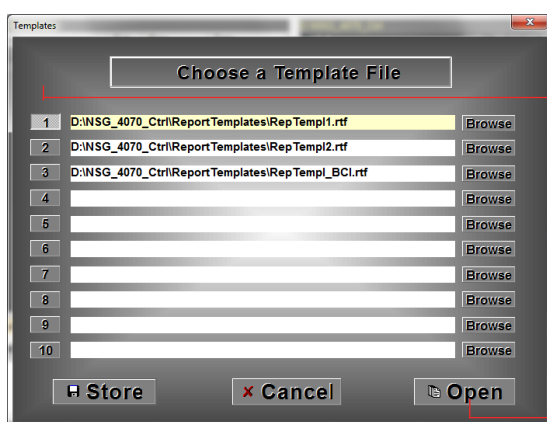
Word processing programs vary widely in their ability to display \*.rtf files, and MS Word was used during NSG 4070 software development. Newer versions of MS Word will activate Smart Tags by default. Before creating a template file Smart Tags must first be deactivated.

## 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.

Press "OPEN" to see the generated report



### Attention:

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

Step by step description for template generation:

Ordner

NSG\_4070\_Ctrl

BCI\_LevDef\_Cal

Calbr\_Files

Example Files

Geraetdaten

November

Reference\_Meas

ReportTemplates

sound

TemplateAssistant

TestSetupPic

Name

Größe

Typ

RepTempl1.rtf

22 KB

Rich Text Format

RepTempl1\_empty.rtf

14 KB

Rich Text Format

RepTempl2.rtf

16 KB

Rich Text Format

RepTempl\_BCI.rtf

15 KB

Rich Text Format

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

Ordner

NSG\_4070\_Ctrl

BCI\_LevDef\_Cal

Calbr\_Files

Example Files

Geraetdaten

November

Reference\_Meas

ReportTemplates

sound

TemplateAssistant

TestSetupPic

Name

Größe

Typ

c3\_TemplateAssistant.exe

104 KB

Anwendung

NSG4070Ctrl.tlb

11 KB

TLIB-Datei

Open the C3 Template Assistant

NSG 4070 Test Report

Date :#C4070.RES.DATECREATED# Company : TE

EUT: :#C4070.RES.EUT#

Notes to EUT: :#C4070.RES.EUT\_NOTE[1]#  
:#C4070.RES.EUT\_NOTE[2]#

Standard : :#C4070.RES.TITLE[2]#

Modulation : :#C4070.SET.MOD# Dwell Time : :#C4070

Amplifier : :#C4070.SET.AMPL# Comment :

Test Title : :#C4070.RES.TITLE[1]#

Compliance3 Template Assistant

NSG4070 Report and Controlling

Inputs

Graph Testlevel (Portrait)

Graph Analog Input (Portrait)

Graph Forward Power (Portrait)

Graph Analog Voltage / Power (Portrait)

Graph Monitoring Probe Current (Portrait)

Graph Calibration Forward Power (Portrait)

Frequency Range

Start Frequency

Stop Frequency

Inserts the result graph of the test level input in portrait orientation

Preview

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

Connected line	Frequency range [MHz]	Test level [EMK]	Step size	Coupl. device	Result File
#C4070.RES.CON.LINE[1]#	#C4070.SET.FRE_RANG[0]#	#C4070.SET.LEV#	#C4070.SET.STEP_F#	#C4070.SET.COUPL_DEV#	#C4070.RES.FILENAME#

Trigger Events:  
:#C4070.RES.TRIG\_EVENT#  
  
Comment:  
:#C4070.RES.COMMENT#

5.9.4.8. 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.

Internal RTF Viewer

File View Options

Edit File Printer Preview

NSG 4070 Test Report

Date :22.11.2013 14:27:18 Company : TESEQ GmbH

EUT:

Notes to EUT:

Standard : DIN EN 61000-4-6; VDE 0847-4-6:2009-12

Modulation : AM 1000 Hz 80 % Dwell Time : 0.100 ms

Amplifier : internal Comment :

Test Title : 4-6 CDN / EM-CLAMP / CIP / DIN EN 61000-4-6; VDE 0847-4-6:2009-12 / NSG 4070-75 Nr: 000016 / V2.09

Connected line	Frequency range [MHz]	Test level [EMK]	Step size	Coupl. device	Result File
0.15..230	3..3 V	1 %	CDN	Test_CDN_M316_131122.res	

5 pages (Cols: 1, Rows: 1, Row 0)

Margin PRINT STO Exit

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 4070-80,000123,V1.0**

**Teseq NSG 4070A-75,000123,V1.0** (For NSG 4070A only. A NSG 4070 can be upgraded to NSG 4070A by replacement of the power meter.)

#### 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:POWer: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:POWer:LEVel:AMPLitude -2.55 dBm**

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

Turns output on/off when in generator mode.

**SOURce: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 6.  
**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. There is an optional frequency parameter to this command. It species the frequency of the signal to be measured. If the frequency parameter is omitted, the output frequency of the NSG 4070 signal generator part is used.

**POWERmeter:CHannel1? 100 MHz**  
**-12.33 dBm**

#### 6.3.2. Channel 2 (POWERmeter:CHannel2?)

Measures the power on channel 2 of the built in power meter. See Chapter 6.3.1 for more details.

**POWERmeter:CHannel2? 100 MHz**  
**5.23 dBm**

#### 6.3.3. Channel 3 (POWERmeter:CHannel3?)

Measures the power on channel 3 of the built in power meter. See Chapter 6.3.1 for more details.

**POWERmeter:CHannel3? 100 MHz**  
**0.57 dBm**

#### 6.3.4. Forward power (POWERmeter:FORWARD?)

Measures the forward power on the amplifier output of the NSG 4070. See Chapter 6.3.1 for more details. Note that this value does not take the internal directional coupler into account. To get the output level at the Amp out socket you have to add the insertion loss of the internal directional coupler. You can obtain the insertion loss of the internal directional coupler with the command MISCellaneous:DIRectional COUPler?.

**POWERmeter:FORWARD? 100 MHz**  
**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 frequency 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.  
**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 with the NSG 4070 Control Program the outputs can be set individually. A deactivated User port output D0 works in the "auto" mode.

### 7.1.1. "Auto" mode

This mode provides a "high" level on User port output D0 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:

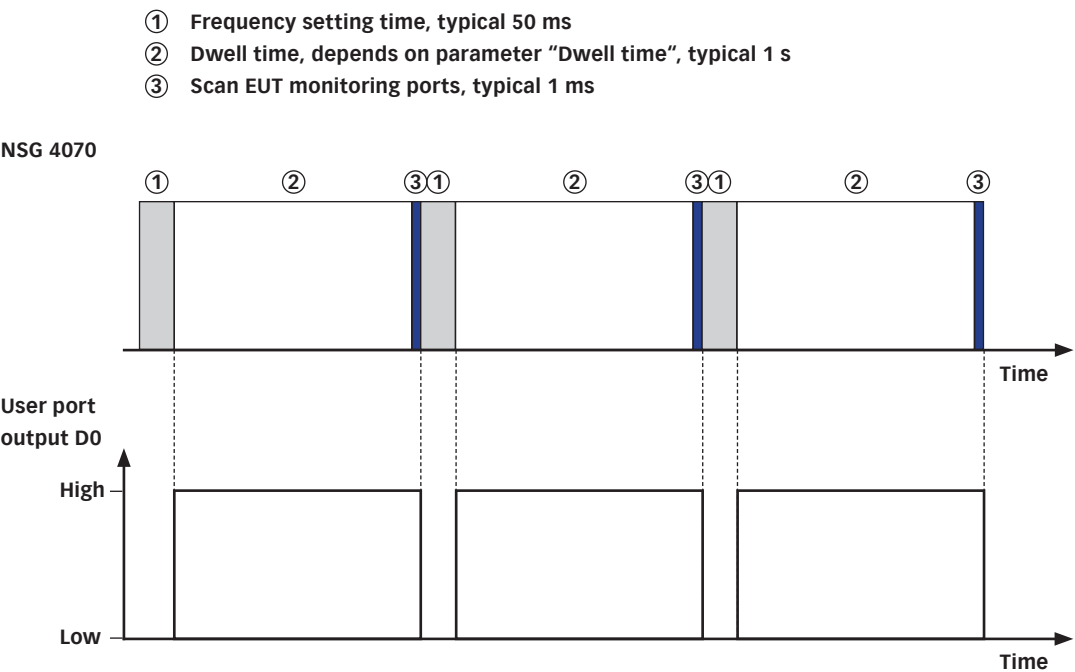


Figure 10: Timing of User port D0 output in "auto" mode

### 7.1.2. Monitoring event

The function "Monit. Event" changes the output level for every EUT monitoring event on the selected output port. Available are: "Low", "High", "LowImp" and "HighImp".

### 7.1.3. Frequency step

The function "Every step" changes the output level for every frequency step on the selected output port. Available are: "LowImp" and "HighImp".



#### **7.1.4. Switching at a defined frequency**

The function "at Fr1" / "at Fr2" changes the output level at a defined frequency (frequency in MHz) on the selected output port. Available are: "Low", "High", "LowImp" and "HighImp".

Note:

Use D3 "low" to switch MD 4070 into the passive mode and "high" to switch into the active mode.

Use D2 "low" to switch SW 4070 to path 1 and "high" to switch to path 2.

The function is disabled during performing the system and probe calibration.

#### **7.1.5. Switching at test start**

The function "at Test Start" changes the output level at test start on the selected output port. Available are: "LowImp" and "HighImp".

## 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 as described in this chapter. The use of the NSG 4070-45 or the combination with external directional coupler and power amplifier allow conducted and radiated immunity tests up to 1 GHz.

### 8.2. IEC/EN 61000-4-6 testing

#### 8.2.1. Requirements

IEC 61000-4-6 (EN 61000-4-6) „Immunity to conducted disturbances, induced by radio frequency fields” defines a method for injecting test signals into the equipment under test (EUT). The basic requirement is to inject a known level of RF signal onto the cable of the EUT at each test frequency and to determine whether the EUT continues to function correctly. In order to do this, it is necessary to decouple the auxiliary equipment (AE) from the test signal. If this is not achieved it is difficult to know whether any fault is due to a failure of the EUT or the AE. The basic requirements are shown in the table below.

Frequency range	150 kHz ... 80 (230) MHz
Common mode impedance	150 $\Omega$ (in exception 50 $\Omega$ )
Test level (EMF)	1 V, 3 V, 10 V and level X, tolerance +19%/-16%
Modulation	1 kHz sinus, tolerance $\pm 100$ Hz, AM, 80%, tolerance +5%/-20%
Dwell time	1 s
Step size	max. 1% of the preceding frequency value
Method for the system calibration	Set-up the coupling device with the 150 $\Omega$ calibration jig, adjust the unmodulated test level (U0/6) and measure on the 50 $\Omega$ output of the jig
Test method	Using the signal levels established during the system calibration process, switch on the modulation
Power limitation if the 150 $\Omega$ can not be meet	Monitoring of the disturbance current and limiting the signal level as follows: $I_{max} = U0/150 \Omega$
Attenuator	$\geq 6$ dB
Output impedance of the test generator	50 $\Omega$
Harmonics and distortion below the carrier level	$\geq 15$ dB (The harmonics and distortion are measured in continuous wave (CW) at 1.8 times the test level without modulation.)

**Table 8: Basic requirements of the standard**

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

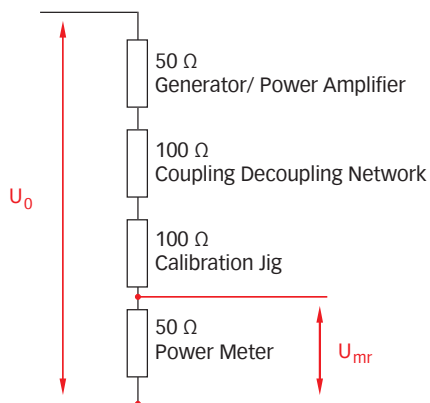
$U_0$  the open-circuit test levels (e.m.f.) of the unmodulated disturbing signal, expressed in r.m.s. are 1 V, 3 V or 10 V. The test levels are set at the EUT port of the coupling devices.

For equipment testing, this signal is 80% amplitude modulated with a 1 kHz sine wave to simulate actual threats.

**$U_{mr} = U_0/6 \pm 19\%/-16\%$ , in linear quantities, or  
 $U_{mr} = U_0 - 15.6 \text{ dB} \pm 1.5 \text{ dB}$  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  $\Omega$  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  $\Omega$  to 50  $\Omega$  adapter terminated by the 50  $\Omega$  measuring equipment.



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

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

**Figure 11: Equivalent circuit diagram and formula**

Test level $U_0$ in V	Measured voltage $U_{mr}$ in V	Measured power on the 50 $\Omega$ power meter in dBm
1	0.1667	-2.55
3	0.5	6.99
10	1.667	17.45
20	3.33	23.47
30	5.00	26.99

**Table 9: Test level and measured voltage**

8.2.3. Test level setting procedure (example: CDN calibration with 1 V test level)

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 system calibration) is shown as an example in the figure below:

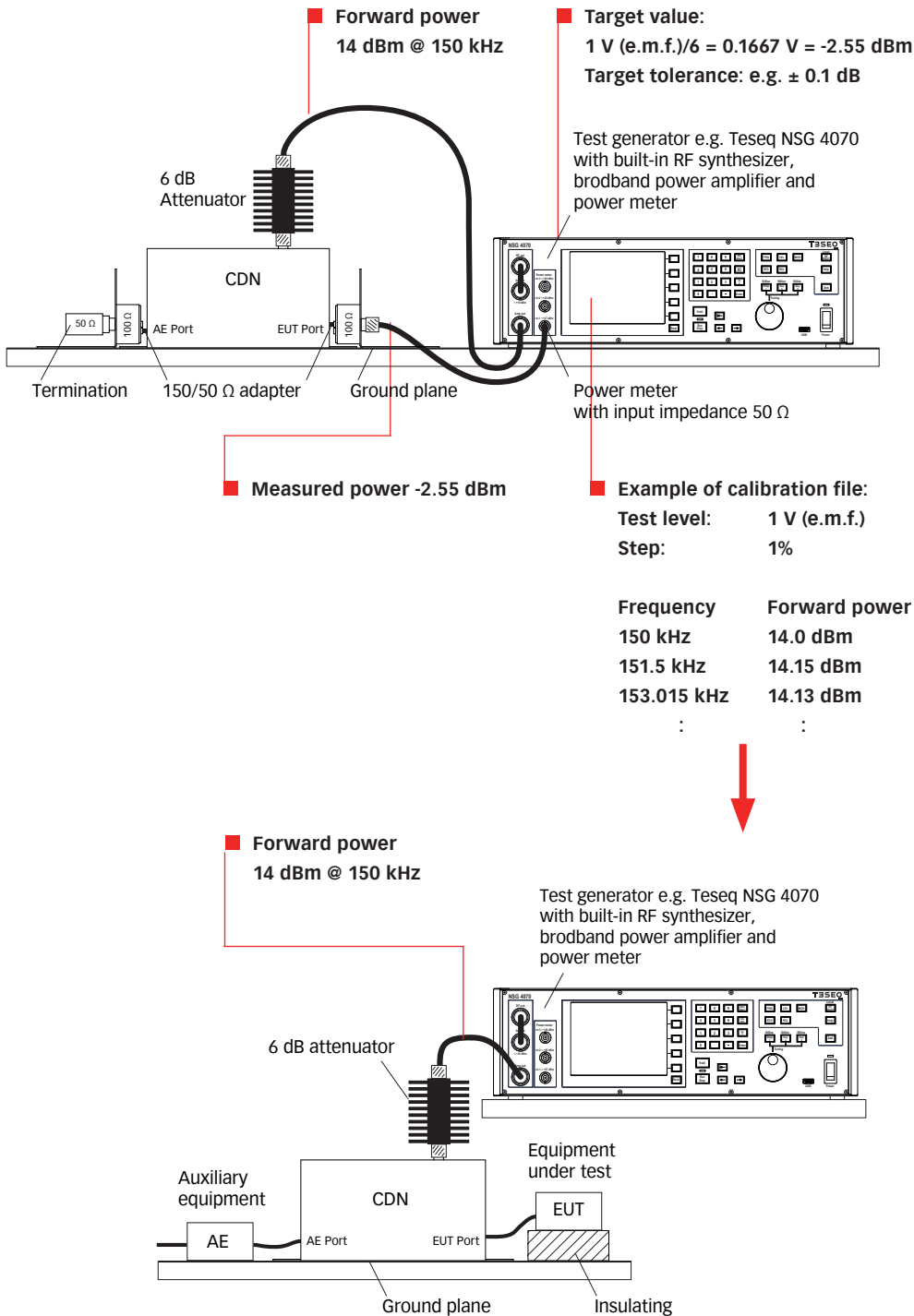
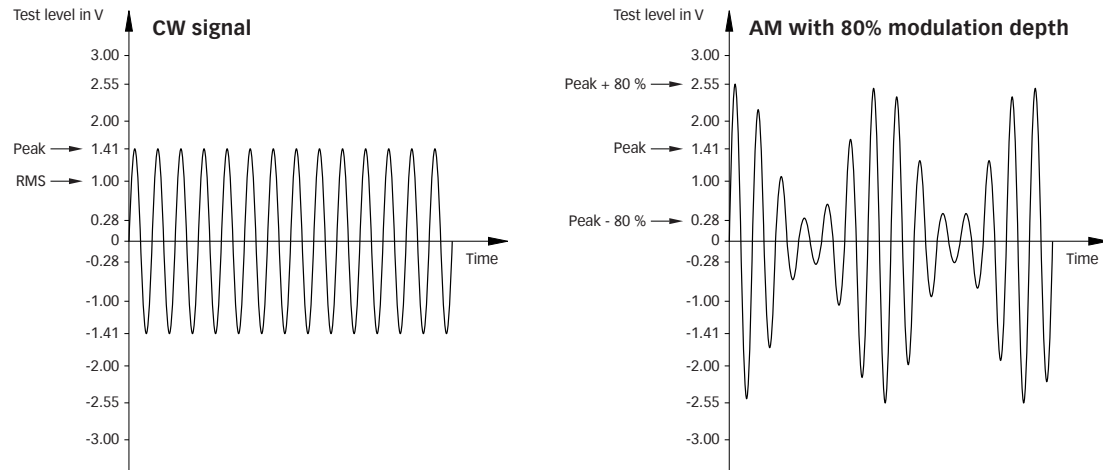


Figure 12: Example for test level setting, relation between test level and measured level (The influence of the modulation is neglected in this sample.)

#### 8.2.4. Modulation

The level setting procedure of IEC / EN 61000-4-6 is done without any modulation. The modulation is switched on during testing. The modulation depth is 80%. The peak value of the envelope of the amplitude modulated signal is increased against the CW signal. See figure 13.

Example: AM with 80% requires 5.1 dB additional power as used for the level setting procedure.



**Figure 13: Amplitude modulation**

#### 8.2.5. Power requirements

The required forward power is in relation to the desired test level, the insertion loss of the coupling device, the 6 dB attenuator, the cable loss and the reserve for the modulation. The table below shows typical power requirements.

Amplifier module:	35 W	45 W	80 W
CDN:	18 V EMF	22 V EMF	30 V EMF
EM clamp (KEMZ 801A):	14 V EMF	16 V EMF	20 V EMF
Current injection clamp (CIP 9136A):	6 V EMF	8 V EMF	10 V EMF (typ.)

**Table 10: 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)

#### 8.2.6. Power amplifier

The nominal frequency range of Teseq's power amplifiers is related to the 3 dB band width. The internal used power amplifier modules provide essential more power in specific frequency ranges as given with the value of the nominal power of 35 W, 45 W and 80 W. Further the power amplifier can also be used outside the nominal frequency range with limited performance. The usable frequency range is between 50 kHz and 320 MHz for the 35 W and 80 W models.

Class A amplifiers are the best choice for EMC testing. Only this principle guarantees providing forward power independent of the matching.

### 8.2.7. 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.

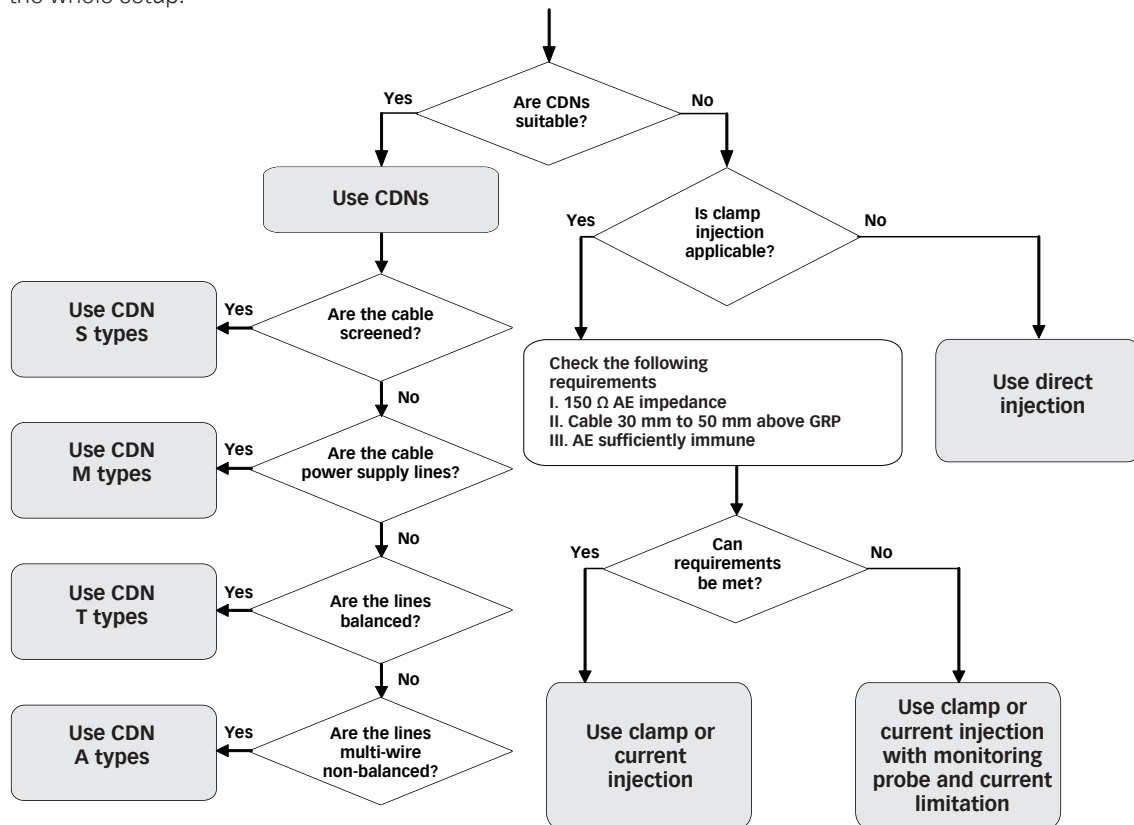
See chapter 4.5.3.2 for details.

### 8.2.8. RF switch

Two power amplifiers can be combined with the optional RF switch SW 4070. The SW 4070 has 2 SPDT relays and is powered and controlled by the NSG 4070 user port. The SW 4070 provides a second user port for connecting e.g. the MD 4070. The path switching is defined in the EUT monitoring menu with digital output D2. See chapter 5.9.3.2 for details.

### 8.2.9. Coupling devices

The selection of the correct coupling device is defined in IEC/EN 61000-4-6. Below is shown a simplified flow chart which should providing help for the selection. The frequency response of the coupling device is measured during the system calibration. Calibration files e.g. in ASCII can not be imported. For investigation purpose (system check) can be used the probe calibration (next chapter). The result is the insertion loss of the whole setup.



**Figure 14: Rules for selecting the injection method (Chapters 7.2 to 7.5 refer to the IEC/EN 61000-4-6 standard.)**

### 8.2.10. Current probe

Teseq recommends using the MD 4070 monitoring probe due to the operating range of the power meter. The active mode of MD 4070 allows also the operation with low stress levels. Details given in Table 11. The active mode requires to connect the power supply with the MD 4070. Using the whole dynamic range requires to

calibrate the MD 4070 in the active and passive mode. The remote controlled switching requires connection with the NSG 4070 user port. The switching is defined in the EUT monitoring menu with digital output D3. See chapter 5.9.3.2 for details.

The probe calibration measures the insertion loss in a 50  $\Omega$  system. Calibration files e.g. in ASCII can not be imported. The NSG 4070 Control Program offers an export function. See chapter 5.7 for details.

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.

Monitor probe	Stress level****
Insertion loss in dB	V EMF
+10*	1 to 3
-22**	1 to 30
-34***	2 to 30

\* typical MD 4070 active

\*\* typical MD 4070 passive

\*\*\* current probe with transfer impedance 1  $\Omega$  (0 dB/ $\Omega$ )

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

**Table 11: Insertion loss of the probe relative to power meter range and stress level**

#### 8.2.11. Calibration jig

Test generator and power meter are designed with 50  $\Omega$  impedance. Test level and EUT port (coupling device) are related to 150  $\Omega$ . The calibration jig supplies the adaptation from 150  $\Omega$  to 50  $\Omega$  and for the common mode. Some calibration jigs terminate the AE port with 150  $\Omega$ .

The current probe needs to be calibrated in a 50  $\Omega$  calibration jig.

#### 8.2.12. Power meter

Channel 1 is used for measuring the stress level during the system calibration and measuring the insertion loss during the probe calibration. Also channel 1 is used to connect the current probe during testing. Power meter channel 2 is used in combination with an external directional coupler for measuring the forward power and channel 3 for measuring the reverse power.

#### 8.2.13. Attenuator

The 6 dB attenuator needs to be suitable for the used forward power. Best would be to be suitable for the max. forward power of the used power amplifier.

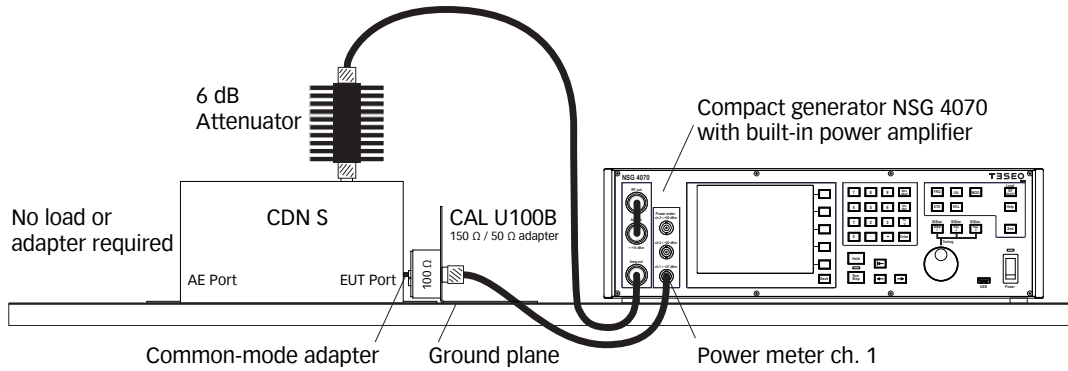
#### 8.2.14. Optically decoupled remote control

The converter USO 4013 allows the remote control of the NSG 4070 via a 20 m Polymeric Optical Fiber (POF). The USO 4013 connects the optical remote interface of the NSG 4070 with the USB interface of the control PC.

Used as M2 CDN



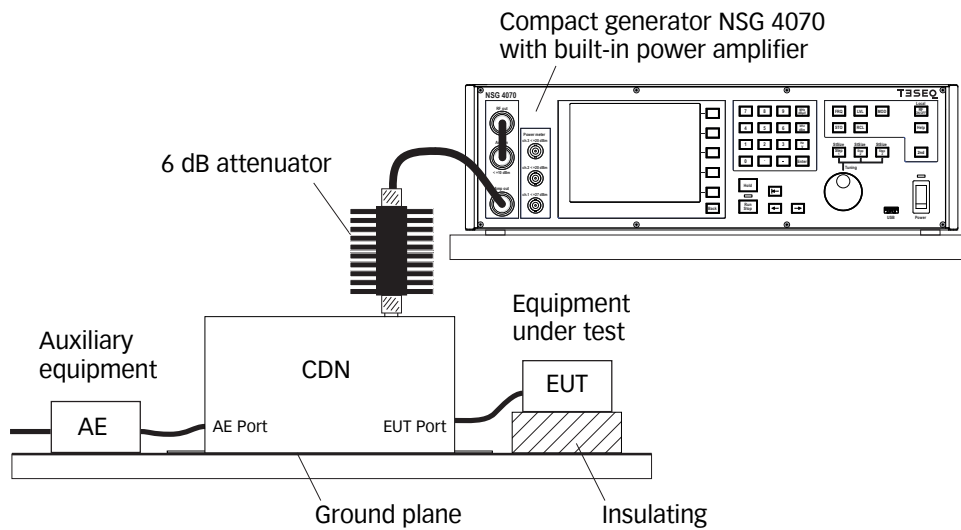




**Figure 17: Test setup calibration with CDN S**

#### 8.2.16. EUT test setup with CDN

After calibration the calibration adapter 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 18: Test setup with EUT**

### 8.2.17. Test setup calibration with EM clamp

The NSG 4070 is connected via a 6 dB attenuator to the RF port of the EM clamp. The EUT port of the EM clamp is connected with a 150  $\Omega$  to 50  $\Omega$  adapter to power meter channel 1. The AE port is terminated with 150  $\Omega$ . Both adapters need to be connected with the supplied cable of the calibration jig. The clamp needs to be clicked on this cable. The setup for the system calibration is shown in figure below:

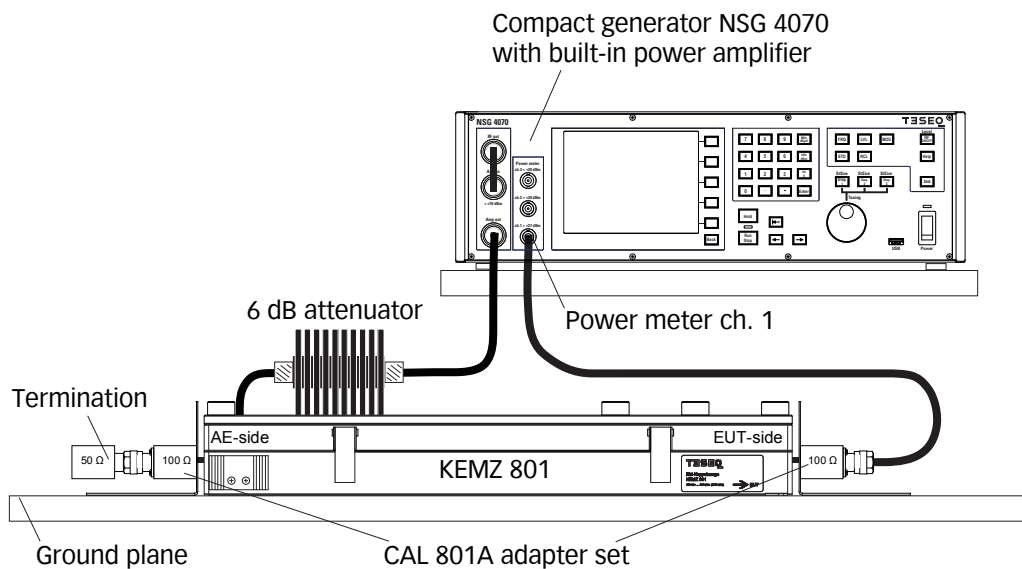


Figure 19: Test setup calibration according IEC/EN 61000-4-6 with EM clamp

### 8.2.18. EUT test setup with EM clamp

After calibration the 150  $\Omega$  to 50  $\Omega$  adapter / 150  $\Omega$  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:

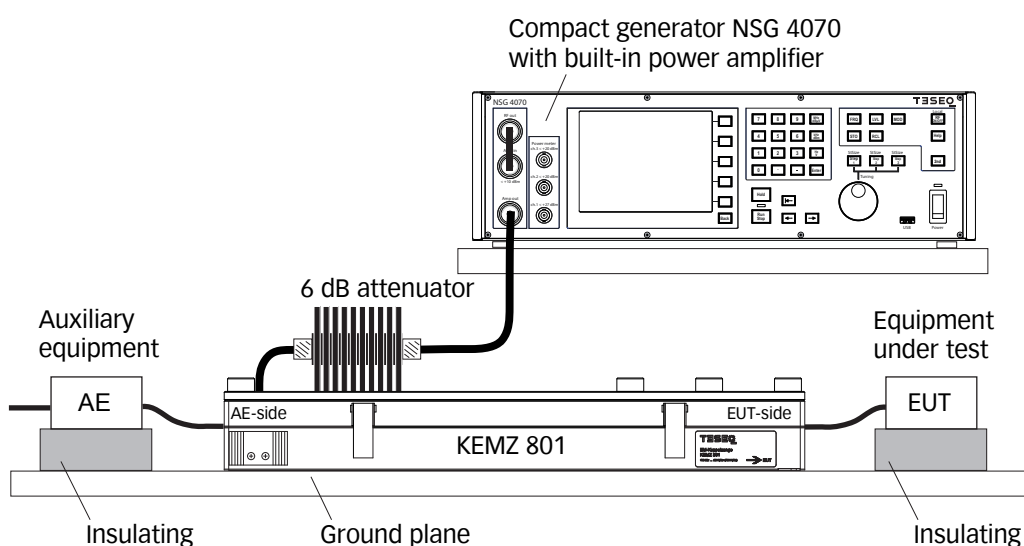
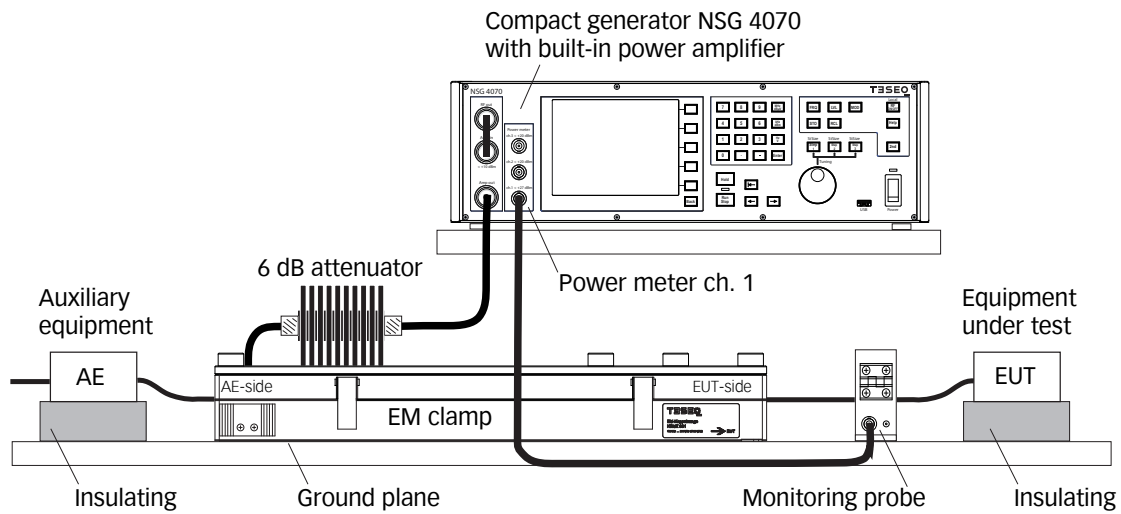


Figure 20: Test setup with EUT according IEC/EN 61000-4-6 with EM clamp

The test setup with using the monitoring probe is shown below.

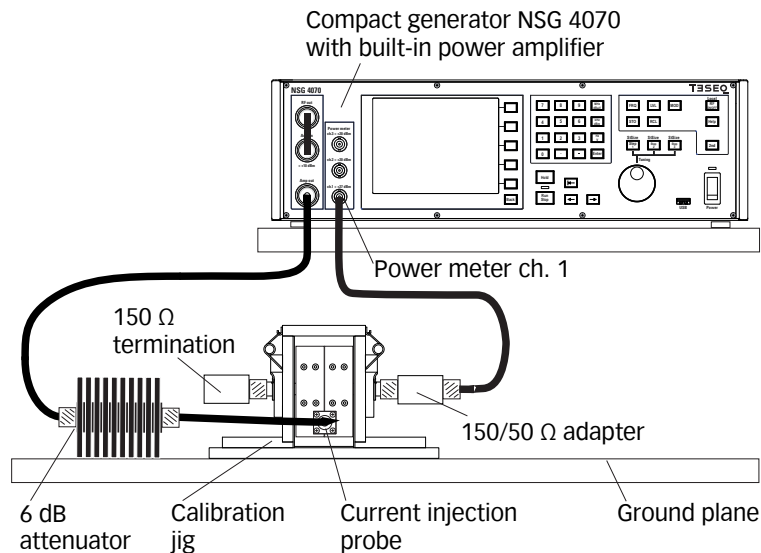
119



**Figure 21: Test setup with EUT according IEC/EN 61000-4-6 with EM clamp and monitoring probe**

#### 8.2.19. Test setup calibration with current injection probe (150 $\Omega$ system)

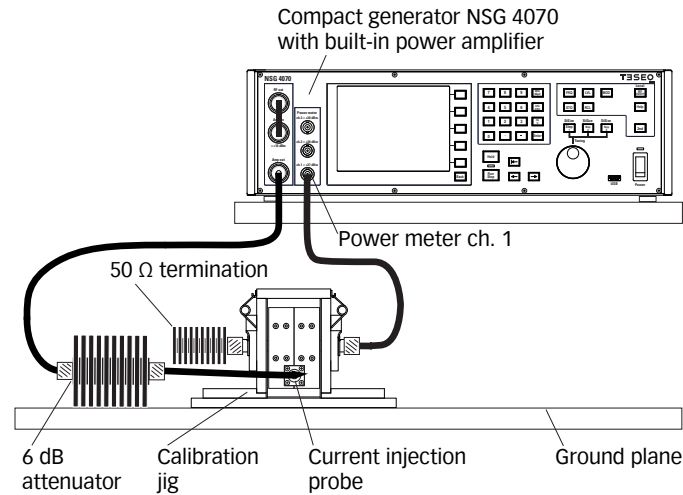
The test generator is connected via 6 dB attenuator to the RF port of the current injection probe. The probe is inserted in a 50  $\Omega$  jig. The jig is connected with a 150  $\Omega$  to 50  $\Omega$  adapter to a power meter with 50  $\Omega$  input impedance. The other side of the jig is terminated with 150  $\Omega$ . The setup for the system calibration is shown in the figure below:



**Figure 22: Test setup calibration according IEC/EN 61000-4-6 with current injection probe**

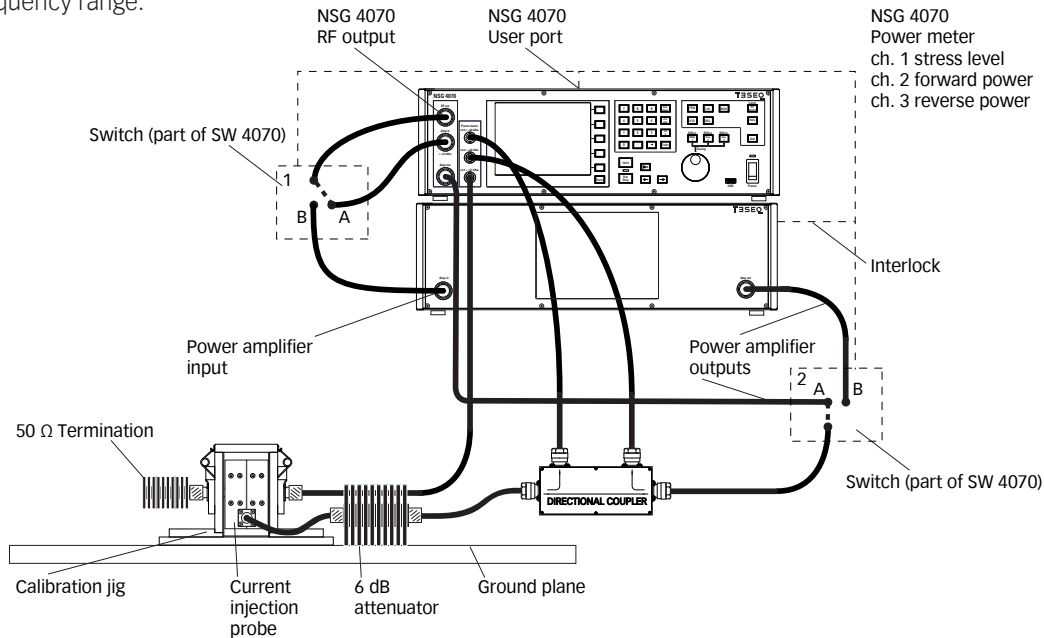
### 8.2.20. Test setup calibration with current injection probe (50 $\Omega$ system)

The test generator is connected via 6 dB attenuator to the RF port of the current injection probe. The probe is inserted in a 50  $\Omega$  jig. The jig is connected to a power meter channel 1. The other side of the jig is terminated with 50  $\Omega$ . All IEC / EN 61000-4-6 setups of the NSG 4070 are based on the 150  $\Omega$ . A conversion factor of -9.5 dB is needed because of the 50  $\Omega$  to 150  $\Omega$  relation. For calibrating in a 50  $\Omega$  system is needed to add -9.5 dB as additional attenuation. Test levels of 10 V EMF may require an additional attenuator of 10 or 20 dB. The resultant factor should be used (Example: 20 dB -9.5 dB = 10.5 dB). See chapter 4.3.3 if using the front panel operation of the NSG 4070 or 5.9.3.7 if using the Windows software. The setup is shown in the figure below:



**Figure 23: Test setup calibration with current injection probe in a 50  $\Omega$  system**

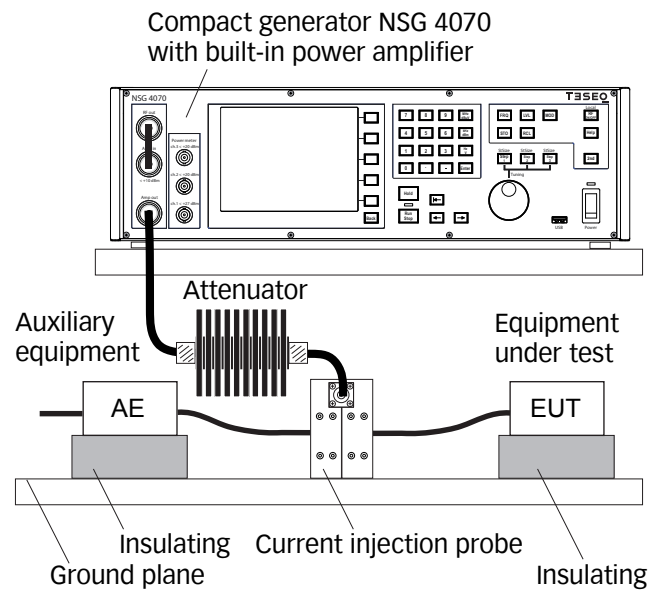
The following figure shows the use of internal and external amplifier ("MIXED" mode) for having an extended frequency range.



**Figure 24: Test setup calibration with current injection probe in a 50  $\Omega$  system, 2 amps**

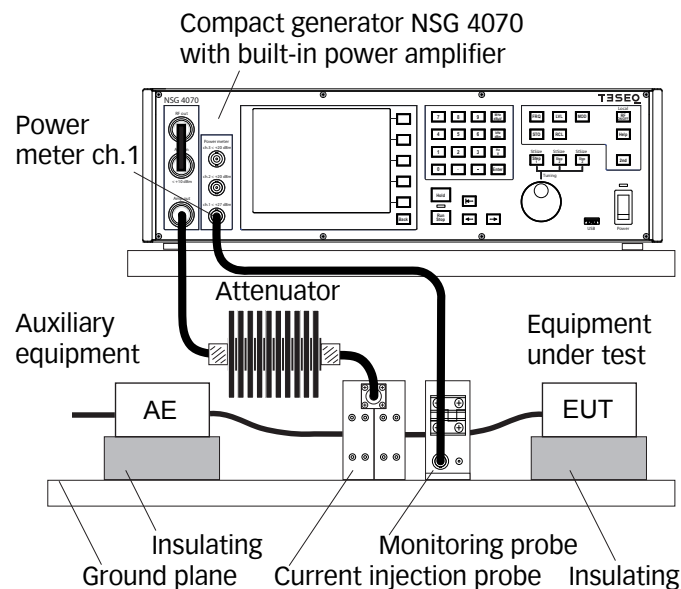
### 8.2.21. EUT test setup with current injection probe

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 25: Test setup with EUT according to IEC/EN 61000-4-6 with current injection probe**

The test setup with using the monitoring probe is shown below.



**Figure 26: Test setup with EUT according to IEC/EN 61000-4-6 with current injection probe and monitoring probe**

8.2.22. Calibration of the monitoring probe

Teseq recommends using the MD 4070 monitoring probe due to the operating range of the power meter. The active mode of MD 4070 allows also the operation with low stress levels. Details given in Table 11. The active mode requires to connect the power supply with the MD 4070. Using the whole dynamic range requires to calibrate the MD 4070 in the active and passive mode. The remote controlled switching requires connection with the NSG 4070 user port. The probe calibration measures the insertion loss in a 50  $\Omega$  system.

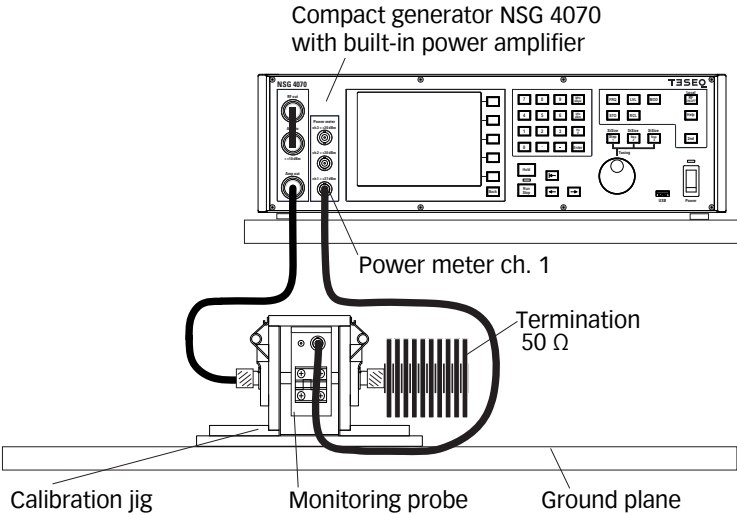


Figure 27: Calibration setup of the monitoring probe

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

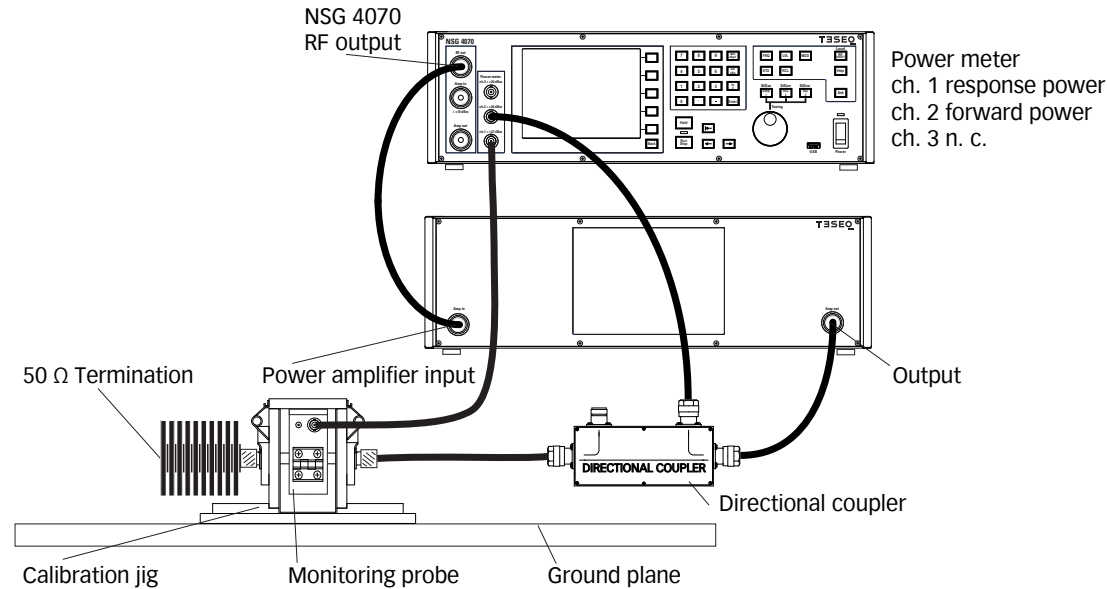


Figure 28: Calibration setup of the monitoring probe with external power amplifier and directional coupler

### 8.2.23. 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 requires always an external directional coupler regardless of the type of NSG 4070 used. For the combination internal and external amplifier is needed the optionally available RF switch SW 4070. A setup is shown in figure 24.

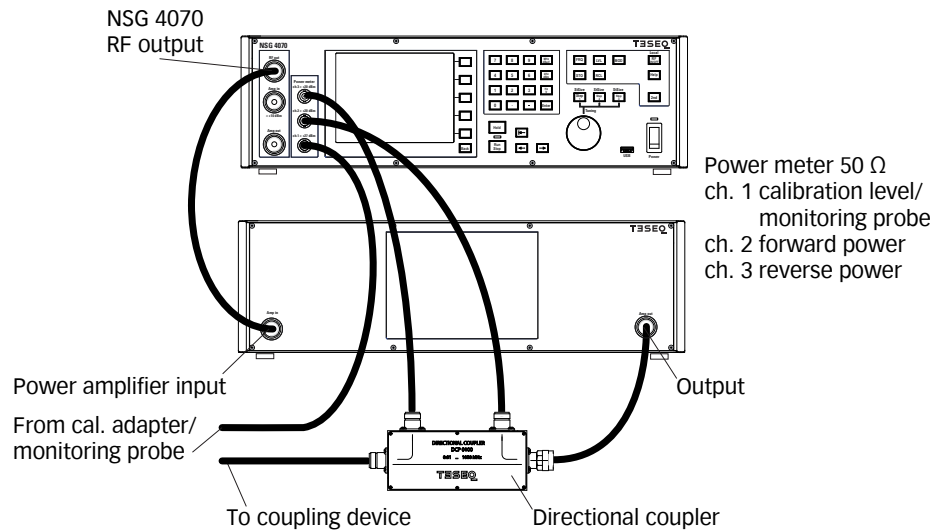


Figure 29: Setup with external power amplifier and directional coupler

### 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 $\Omega$ (special case 50 $\Omega$ )	50 $\Omega$
Stress level	Voltage EMF	Current in mA or dB $\mu$ A
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 $\Omega$ condition cannot be meet)	Substitution Substitution (current measurement probe use is optional) Closed loop with power limitation
Additional equipment	6 dB attenuator	Reverse power measurement

**Table 12: Differences between IEC/EN 61000-4-6 and BCI**

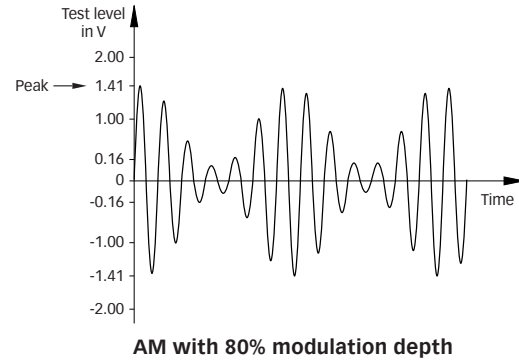
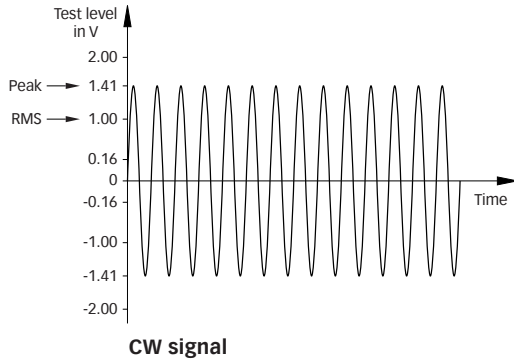
#### 8.3.3. Stress level

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. 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 13: 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 14: Power requirements for stress levels in mA (calculated with 1 dB cable loss)

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

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

$P_{\text{CW limit}}$  is the power limit  
 $P_{\text{for cal}}$  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 (6 dB) 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. (see also table 14)

### 8.3.7. Power amplifier

The nominal frequency range of Teseq's power amplifiers is related to the 3 dB band width. The internal used power amplifier modules provide essential more power in specific frequency ranges as given with the value of the nominal power of 35 W, 45 W and 80 W. Further the power amplifier can also be used outside the nominal frequency range with limited performance. The usable frequency range is between 50 kHz and 320 MHz for the 35 W and 80 W models.

BCI testing requires to include external power amplifiers due to the requested frequency and power range. Class A amplifiers are the best choice for BCI testing. Only this principle guarantees providing forward power independent of the matching. The maximum linear output power is given already below 0 dBm input power (see also Chapter 9.4 parameter "Max. input power linear").

### 8.3.8. RF switch

Two power amplifiers can be combined with the optional RF switch SW 4070. The SW 4070 has 2 SPDT relays and is powered and controlled by the NSG 4070 user port. The SW 4070 provides a second user port for connecting e.g. the MD 4070. The path switching is defined in the EUT monitoring menu with digital output D2. See chapter 5.9.3.2 for details.

### 8.3.9. BCI probe

For BCI testing is recommended the CIP 9136A for the frequency range 10 kHz to 400 MHz. The frequency response of the BCI probe is measured during the system calibration. Calibration files e.g. in ASCII can not be imported. For investigation purpose (system check) can be used the probe calibration (next chapter). The result is the insertion loss of the whole setup.

### 8.3.10. Current probe

Teseq recommends using the MD 4070 monitoring probe due to the operating range of the power meter. The active mode of MD 4070 allows also the operation with low stress levels. Details given in Table 15. The active mode requires to connect the power supply with the MD 4070. Using the whole dynamic range requires to calibrate the MD 4070 in the active and passive mode. The remote controlled switching requires connection with the NSG 4070 user port. The switching is defined in the EUT monitoring menu with digital output D3. See chapter 5.9.3.2 for details.

The probe calibration measures the insertion loss in a 50  $\Omega$  system. Calibration files e.g. in ASCII can not be imported. The NSG 4070 Control Program offers an export function. See chapter 5.7 for details.

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.

Monitor probe	Stress level range (calculated with power limitation factor 4)	
Insertion loss in dB	mA	dB $\mu$ A
+10*	0.03 to 16	30 to 84
-22**	1.1 to 500	60 to 114
-34***	4.5 to 2500****	72 to 128

\* typical MD 4070 active

\*\* typical MD 4070 passive

\*\*\* current probe with transfer impedance 1  $\Omega$  (0 dB/ $\Omega$ )

\*\*\*\* typical limit at 1000 mA caused by the probe

**Table 15: Probe insertion loss relative to power meter range and stress level**

**8.3.11. Calibration jig**

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.

**8.3.12. Power meter**

Channel 1 is used for measuring the stress level during the system calibration and measuring the insertion loss during the probe calibration. Also channel 1 is used to connect the current probe during testing. Power meter channel 2 is used in combination with an external directional coupler for measuring the forward power and channel 3 for measuring the reverse power.

The power meter must be protected by an adequate 50 Ω attenuator in case the stress level plus adjustment tolerance exceeds the power limit of 27 dBm (see the yellow marked range in Table 16).

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 16: Stress level conversion**

**8.3.13. Termination**

The power requirements for the 50 Ω load are on the same level as the stress level (see Table 16). For example: A stress level of 400 mA requires at least a 8 W attenuator.

**8.3.14. Optically decoupled remote control**

The converter USO 4013 allows the remote control of the NSG 4070 via a 20 m Polymeric Optical Fiber (POF). The USO 4013 connects the optical remote interface of the NSG 4070 with the USB interface of the control PC.

### 8.3.15. 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  $\Omega$  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:

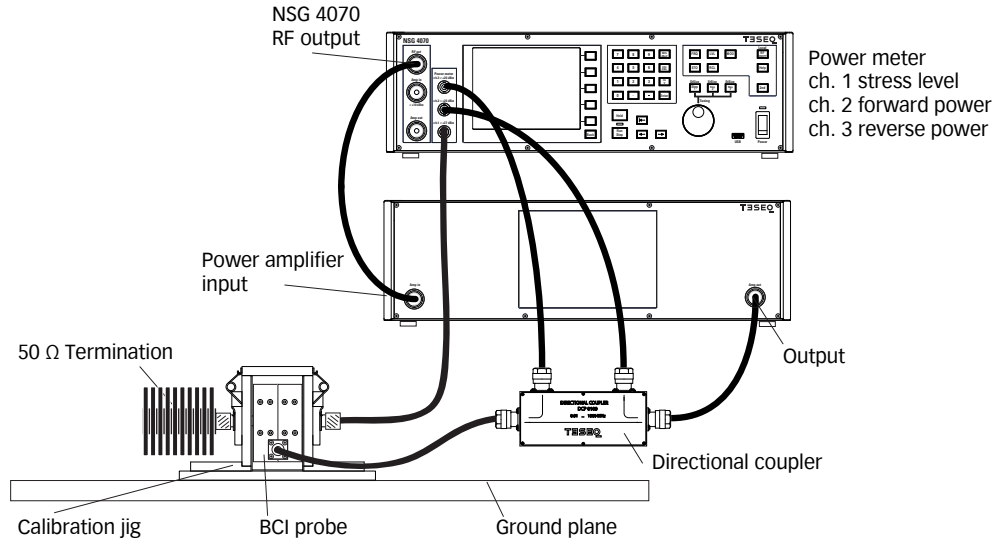


Figure 30: BCI calibration setup

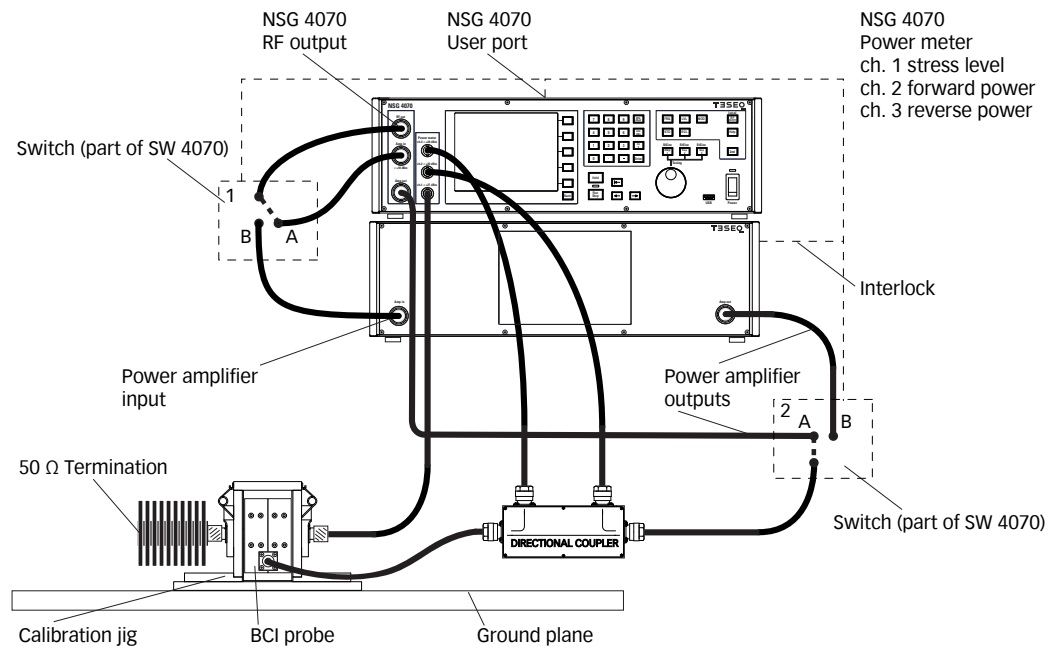


Figure 31: BCI calibration setup with internal and external power amplifier (Mix operation)

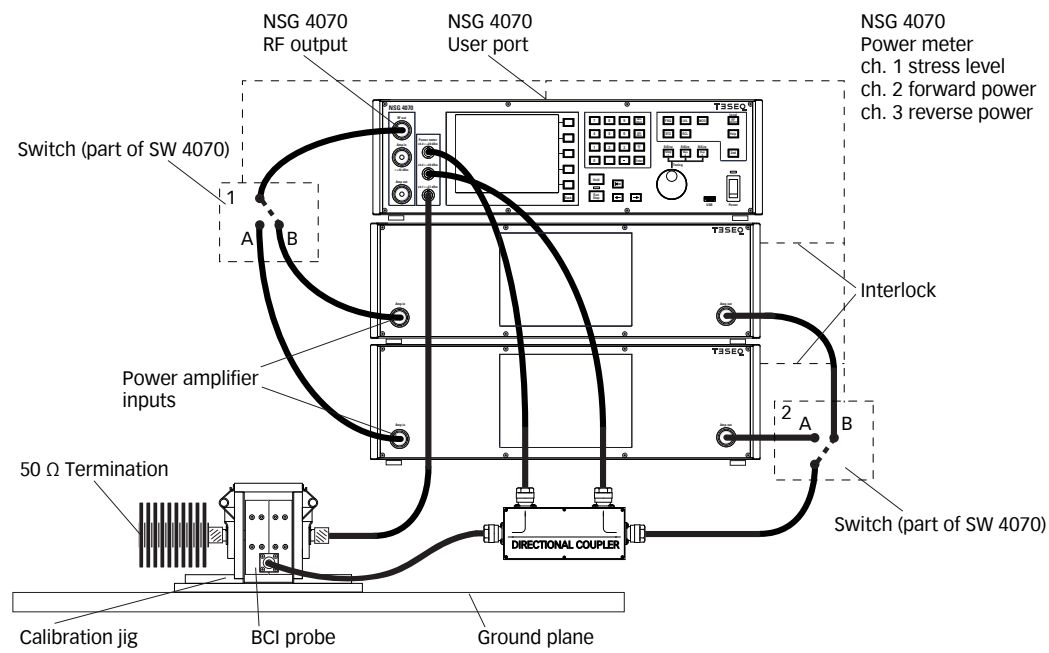
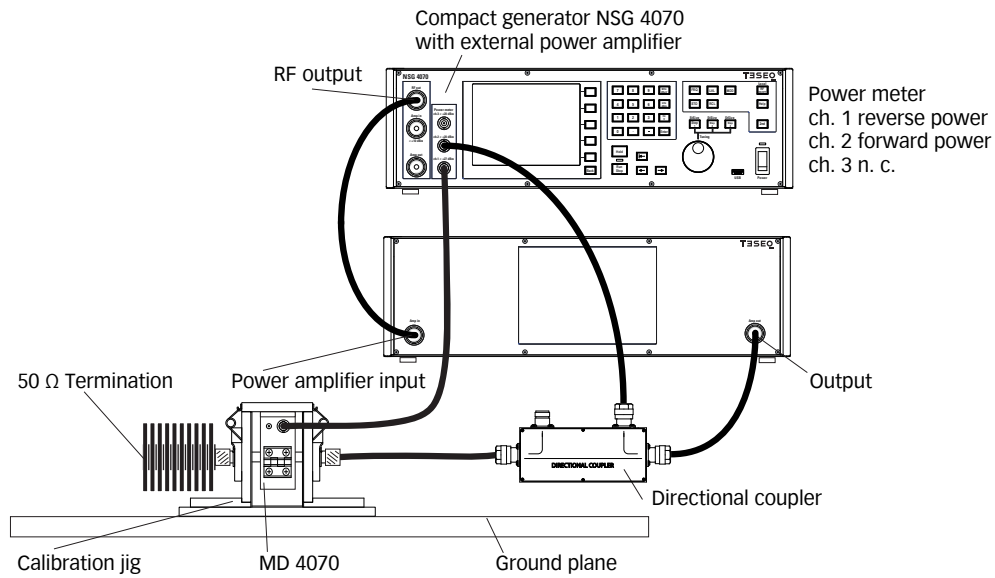


Figure 32: BCI calibration setup with two external power amplifiers

### 8.3.16. Calibration of the monitoring probe

The following figure shows one typical setup for the probe calibration. More opportunities are given with the combination of internal and external or with two external power amplifiers.



**Figure 33: Probe calibration setup**

8.3.17. 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 34. Figure 35 shows the setup for the substitution method with current monitoring probe for the Closed loop method.

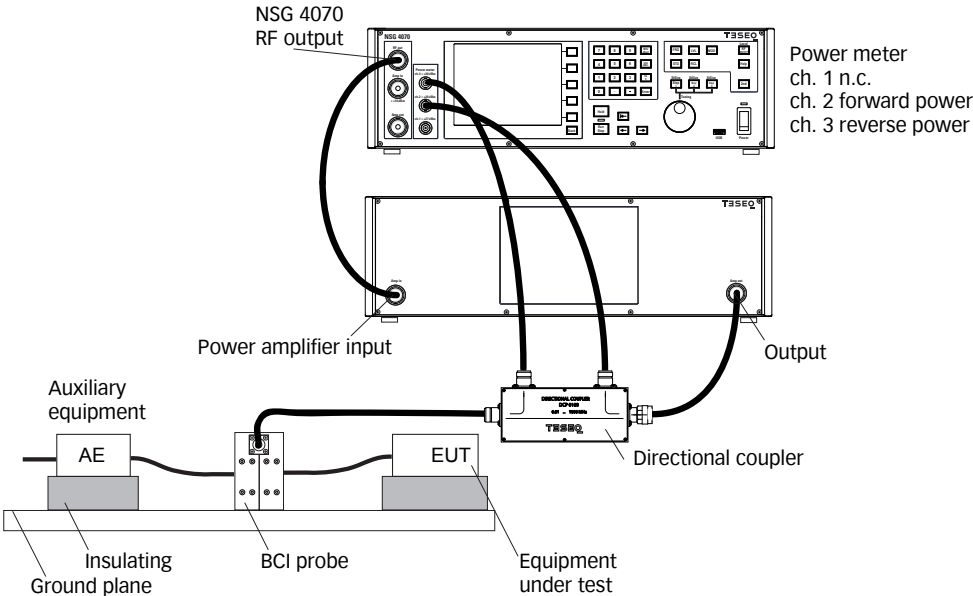


Figure 34: BCI test setup without current monitoring probe

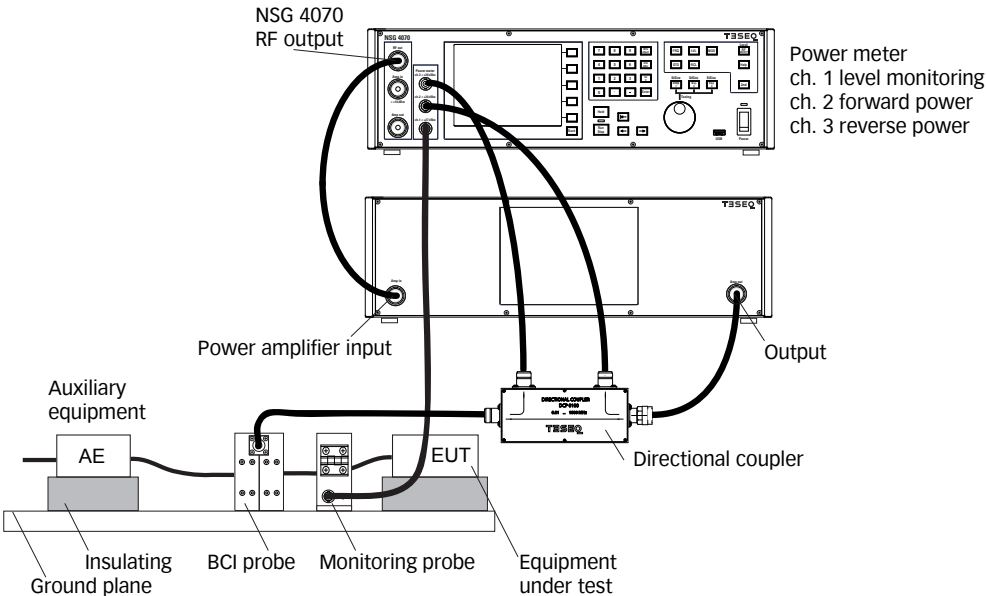


Figure 35: BCI test setup with current monitoring probe



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. Setup examples for radiating testing

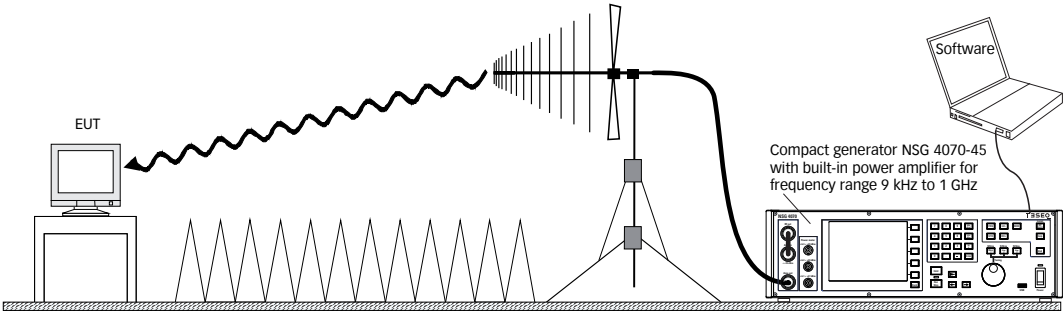


Figure 36: Setup with antenna and NSG 4070-45

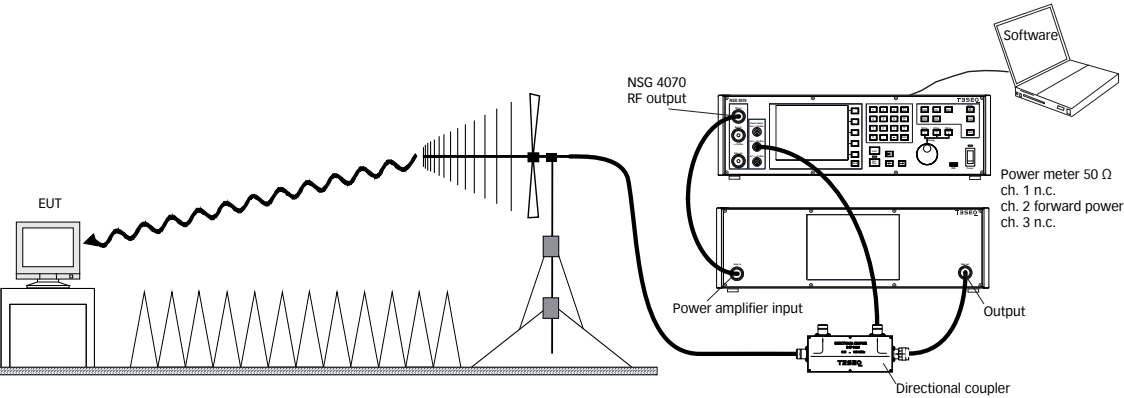


Figure 37: Setup with antenna and NSG 4070 with external power amplifier

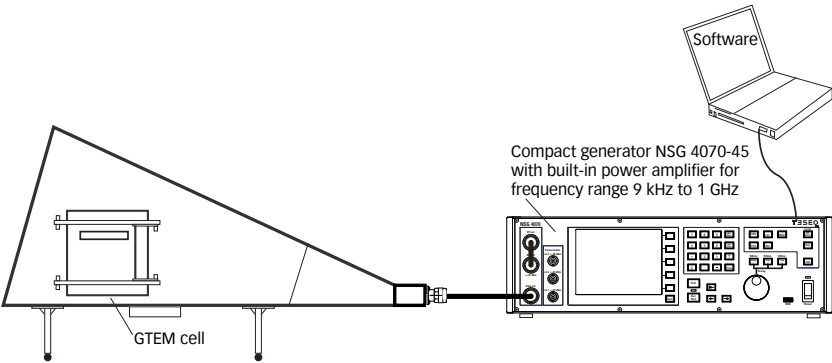


Figure 38: Setup with GTEM cell and NSG 4070-45

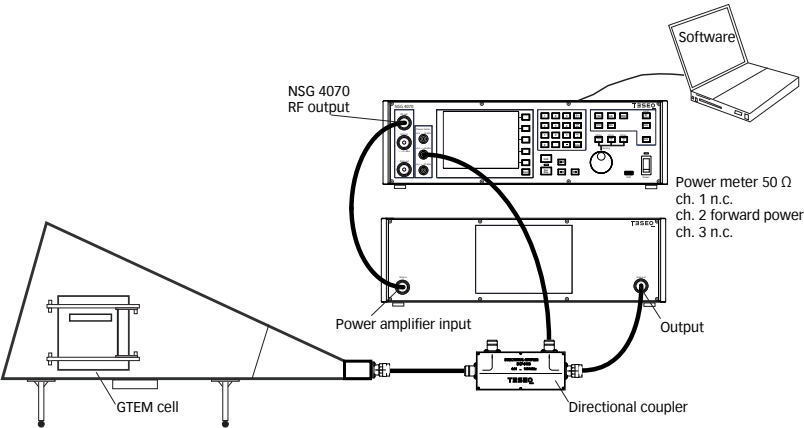


Figure 39: Setup with GTEM cell and NSG 4070 with external power amplifier

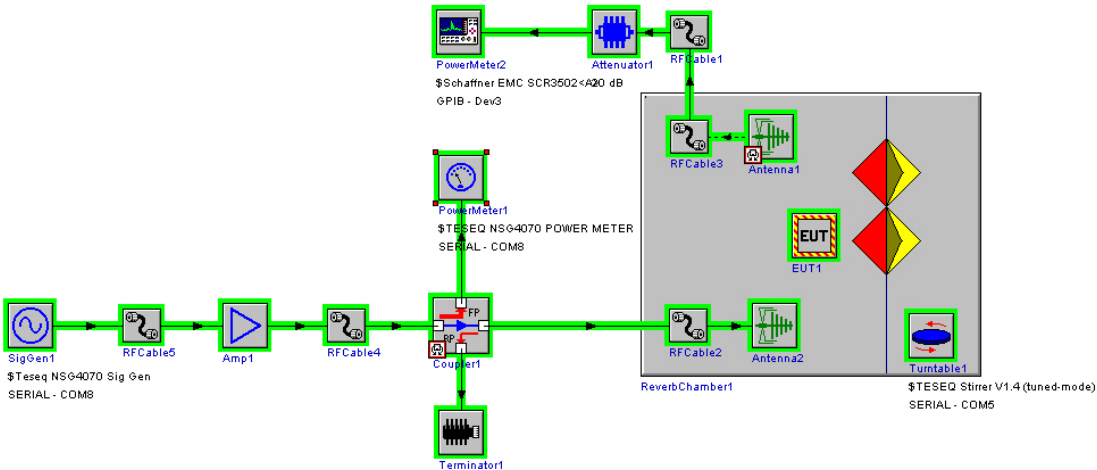


Figure 40: Compliance 5 test house software configuration of a reverberation chamber setup with NSG 4070

## 9. TECHNICAL SPECIFICATIONS

### 9.1. Generator

RF	
Frequency range:	9 kHz to 1 GHz
Resolution:	1 Hz
Reference frequency:	10 MHz
Aging:	25 ppm
RF Level	
Level range:	-60 dBm to +10 dBm
Resolution:	0.1 dB
Settling time:	10 ms
Amplitude modulation	
Modulation depth:	0 to 100%
Modulation frequency range:	1 Hz – 50 kHz
Frequency resolution:	1 Hz
Pulse modulation	
Rise/fall time (10%/90%):	< 1 $\mu$ s
Modulation frequency range:	1 Hz to 50 kHz
Frequency resolution:	1 Hz
Duty cycle:	10% to 90%
External modulation	
Delay time:	< 1 $\mu$ s / 180°
Period:	min. 20 $\mu$ s
Pulse width:	min. 10 $\mu$ s

### 9.2. Power meter

Frequency range:	9 kHz – 1 GHz
Linear measurement range	
channel 1:	-35 dBm to +27 dBm
channel 2,3:	-45 dBm to +20 dBm
Max. input/no damage	
channel 1-3:	+28 dBm
Noise level:	>5 dB below the measurement range
Input return loss:	>20 dB (below 500 MHz), >17 dB (500 MHz to 1 GHz)
Connector:	BNC socket, 50 $\Omega$
Accuracy 10 to 30°C:	<0.5 dB, typ. <0.3 dB

**9.3. Power amplifier**

Nominal output power:	<b>35 W</b>	<b>45 W (preliminary)</b>		<b>80 W</b>
Frequency range:	150 kHz to 230 MHz	9 kHz to 1 GHz		150 kHz to 230 MHz
Input impedance:	50 $\Omega$	50 $\Omega$		50 $\Omega$
Output impedance:	50 $\Omega$	50 $\Omega$		50 $\Omega$
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. 48 dB	min. 50 dB		min. 50 dB
Gain flatness:	max. +/- 3 dB	max. +/- 3 dB		max. +/- 3 dB
Saturated output power:	min. 45.4 dBm	< 400 MHz 46.5 dBm	> 400 MHz 45.4 dBm	min. 49 dBm
Linear output power:	min. 44 dBm	< 400 MHz 45.4 dBm	> 400 MHz 43 dBm	min. 48 dBm
Max. input power without damage:	max. +10 dBm	max. +10 dBm		max. +10 dBm
Harmonic distortion at linear output power:	typ. < -17 dBc	typ. < -20 dBc		typ. < -20 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 routines for IEC 61000-4-6 level 1 to 3 and X up to 30 V EMF, for BCI tests levels in units mA or dB $\mu$ A
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:	manual search by changing 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 35 W / 45 W / 80 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, dB $\mu$ V) 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 $\Omega$ , 9 kHz – 1 GHz
Power amplifier input:	N socket 50 $\Omega$ , max. +10 dBm
Power amplifier output:	N socket 50 $\Omega$
Power meter channel 1 to 3:	as defined in chapter "Power meter"
Back panel	
Monitoring input analog:	BNC socket, 0-24 V $R_i=15$ k $\Omega$ , 6 mV resolution
External modulation input:	BNC socket, impedance >10 k $\Omega$ , level: 1 Vpp to get 100% AM, 1 Hz – 50 kHz
10 MHz reference output:	BNC socket, approx. 1 Vpp/50 $\Omega$

### 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:	BNC socket 0-24 V via optical coupler, $R_i=1.5\text{ k}\Omega$ , 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
RS232 optical:	Connector 2 x HFBRx523 socket for 1 mm fiber optic cable with length between 5 m and 30 m with 115200 Bd, for other distances 38400 Bd, max. 50 m
2x USB	USB host connector for USB stick, keyboard, mouse
USB device connector:	for remote control
Network:	RJ45, Ethernet 10/100 BASE-T

### 9.7. Power supply

	Power supply 100 to 230 VAC 50/60 Hz, autoranging	Fuse F1 for nominal 110 V	Fuse F1 for nominal 230 V
NSG 4070-0	power consumption approx. 80 W	1 A (slow)	0.5 A (slow)
NSG 4070-35	power consumption approx. approx. 415 W	6.3 A (slow)	2.5 A (slow)
NSG 4070-45	power consumption approx. approx. 415 W	6.3 A (slow)	2.5 A (slow)
NSG 4070-80	power consumption approx. 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)

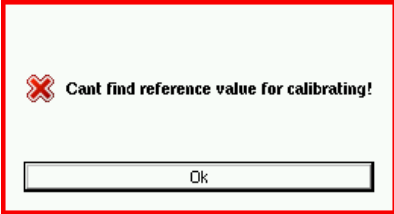
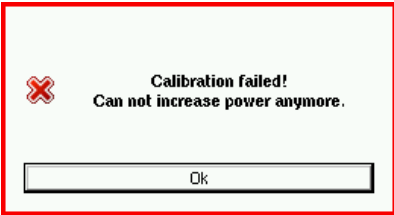

## 10. TROUBLESHOOTING



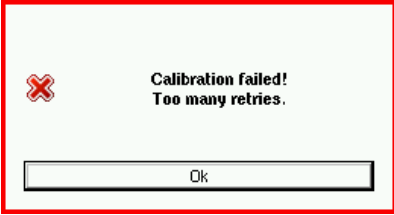

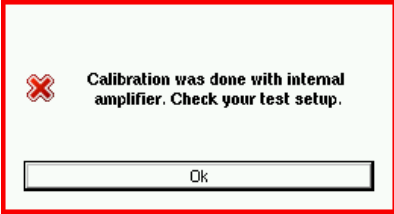

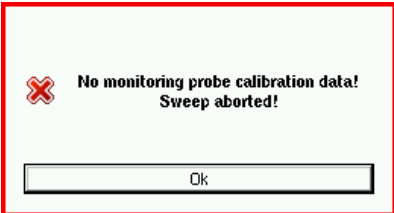
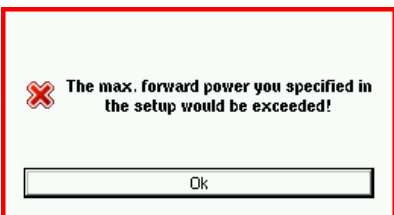
### Re-check the unit before beginning troubleshooting

- 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.	<ul style="list-style-type: none"> <li>■ Plug the power supply cord securely into the power outlet.</li> <li>■ Check if standby LED is on (Orange).</li> <li>■ Check if the outlet is supplied with power.</li> <li>■ Check the fuse.</li> </ul>	3.2.1 3.2.2
	Power meter is working below the measuring range. <ul style="list-style-type: none"> <li>■ Increase the stress level.</li> <li>■ Insert an additional attenuator in the path to the coupling device.</li> <li>■ Reduce the frequency range for calibrating a monitor probe. The insertion loss / amplification might be too high.</li> </ul>	4.5.1.1 8.2.10 4.5.1.4
	Power amplifier limit is reached. <ul style="list-style-type: none"> <li>■ Check your setup.</li> <li>■ Check the connections.</li> <li>■ Decrease the stress level.</li> </ul>	4.5.1.1
	Power meter ch.1 limit will be exceeded. <ul style="list-style-type: none"> <li>■ There is not an attenuator or the used additional attenuator is not enough. Insert an additional attenuator in the path to the power meter channel 1 and put this value in the Setup -&gt; Power Limits menu.</li> <li>■ Decrease the stress level.</li> </ul>	8.3.5 4.3.4



Symptom	Check	Chapter
	<p>Target level cannot be achieved.</p> <ul style="list-style-type: none"> <li>■ Check the connection to channel 2 if using external directional coupler</li> </ul>	<p>8.2.10 8.2.11 8.3.5</p>
	<p>Power amplifier is saturated and not able to have the reserve needed for the modulation</p> <ul style="list-style-type: none"> <li>■ Check the connections of power meter ch. 2 if external amplifier / directional coupler is used.</li> <li>■ Use the saturation check</li> <li>■ Decrease the stress level.</li> </ul>	<p>4.5.3.2 4.5.1.1</p>
	<ul style="list-style-type: none"> <li>■ Use the same amplifier (internal / external) as used for the calibration.</li> </ul>	<p>4.5.1.3</p>
	<ul style="list-style-type: none"> <li>■ First recall calibration file or perform calibration, then start test.</li> </ul>	<p>4.5.3.4 4.5.5</p>
	<p>Tests using of the monitoring probe require recall of both the system calibration file <u>and</u> monitor probe calibration file.</p> <ul style="list-style-type: none"> <li>■ Recall system calibration file <u>and</u> monitor probe calibration file, then start test.</li> </ul>	<p>4.5.3.4 4.5.3.5 4.5.5</p>
	<ul style="list-style-type: none"> <li>■ Check the specified limitation of the max. forward power in the Setup -&gt; Power Limits menu.</li> <li>■ Check the connections</li> <li>■ Decrease the stress level.</li> </ul>	<p>4.3.4 4.5.1.1</p>

Symptom	Check	Chapter
<p>The screenshot shows a red 'X' icon followed by the text 'Initial PM check failed! Please check your measurement setup!'. Below the text is an 'Ok' button.</p>	<ul style="list-style-type: none"> <li>■ Check the connection.</li> <li>■ Insertion loss or amplification of the probe calibration setup is out of range.</li> </ul>	9.4.2
<p>The screenshot shows a red 'X' icon followed by the text 'Calibration failed! Too much power on CH1'. Below the text is an 'Ok' button.</p>	<p>Power meter ch.1 limit will be exceeded.</p> <ul style="list-style-type: none"> <li>■ Insert an additional attenuator in the path to the power meter channel 1 and put this value in the Setup -&gt; hardware menu.</li> <li>■ Decrease the stress level.</li> </ul>	8.3.5 4.3.4
Error adjusting test level!	<p>Power meter for adjusting the forward power is in the noise or not connected.</p> <ul style="list-style-type: none"> <li>■ Establish the connection.</li> <li>■ Increase the stress level.</li> <li>■ Increase the start level of the threshold search.</li> </ul>	

### 10.1. Procedure to check the function of the power meters

The power meter inputs are very sensitive and can be damaged very easily. The following step-by-step description provides a simple test procedure. A damaged power meter channel shows clear visible differences to the generator level. Please avoid any direct connection of the amplifier output to the power meter inputs. See chapter 1.11 for more details.

Generator output

Compact generator NSG 4070

RF cable

Power meter

①

②

1. Connect the NSG 4070 with a suitable mains socket.
2. Switch the unit on.
3. Connect "RF out" (Generator output) with the power meter. (NSG 4070 with built-in power-amplifier are supplied with a bridge between "RF out" and "Amp in". This bridge needs to be removed for this check procedure.) **Do not connect "Amp out" with the power meter!**

4. Press "POWER METER". Related to the default settings will be used a frequency of 100 MHz and a generator level of -30 dBm. Modulation and RF are switched off.

5. Press "CH. 1".
6. Press the hardkey "RF ON/OFF".

7. The symbol shows the RF is switched on.
8. Compare the generator power level with power meter readings. The example shows a damaged power meter channel 1.

9. Change the setup and connect one of the other power meter input. Activate the power meter input by using the specific softkey. Compare the generator power level with power meter readings. Repeat this step with the last power meter.

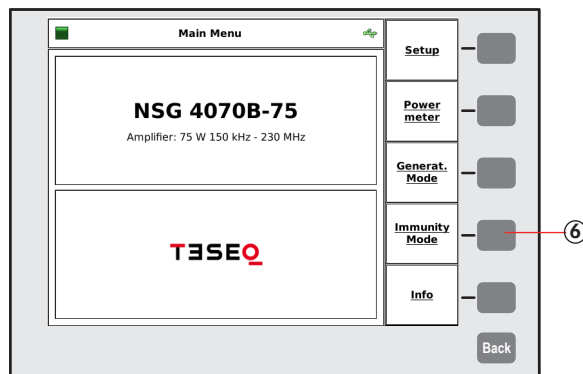
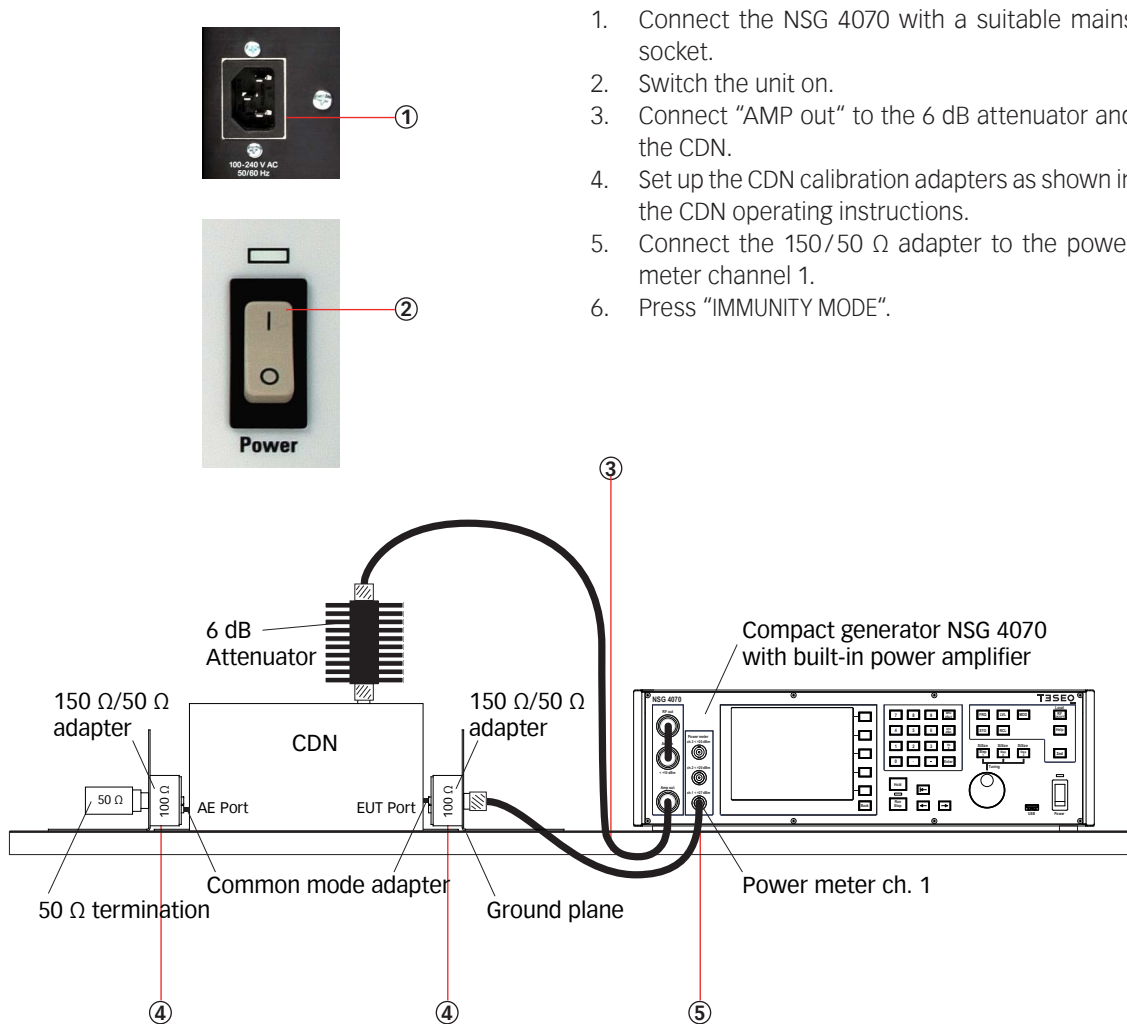
## 11. EXAMPLES

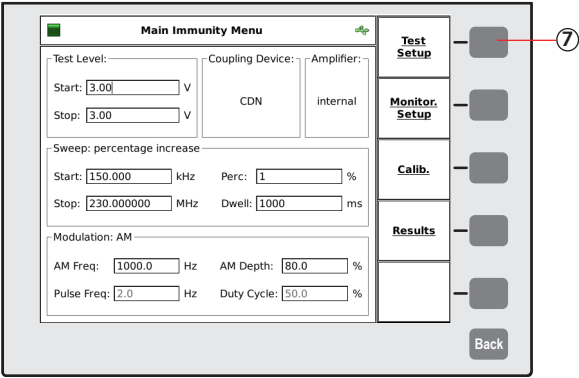
The following examples show the operation of the NSG 4070. Examples are given for testing IEC / EN 61000-4-6 and Automotive BCI.

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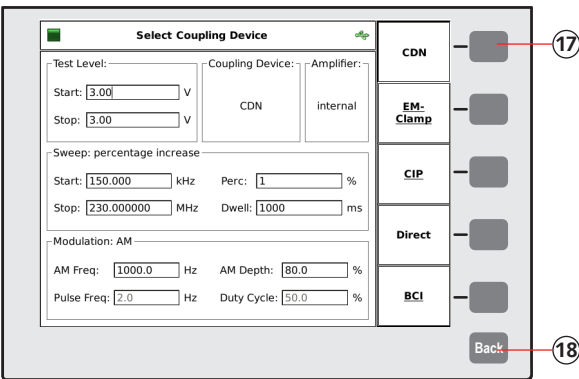
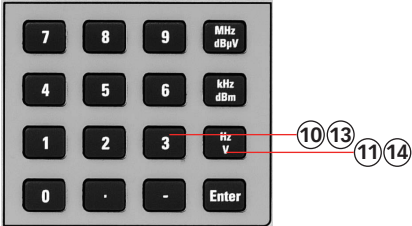
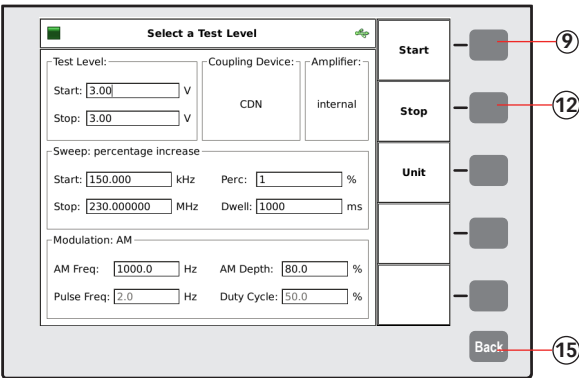
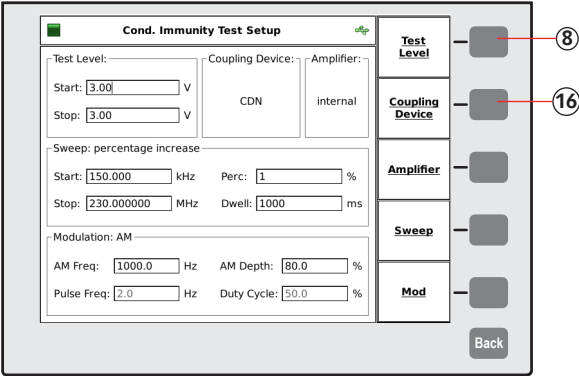
### 11.1. Example 1: IEC/EN 61000-4-6 testing with CDN

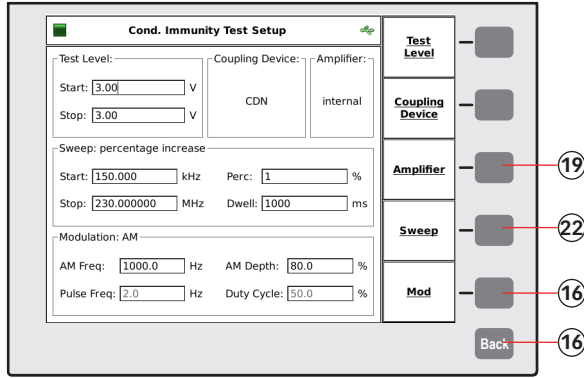
The following example shows the menu-controlled operation of the NSG 4070 for performing tests according to IEC/EN 61000-4-6 with CDNs. This example requires a NSG 4070 with a built-in power amplifier, like the NSG 4070-35, NSG 4070-45 or NSG 4070-80. The CDN must be supplied with calibration adapters for level setting. A 6 dB attenuator and some RF cables are also required.



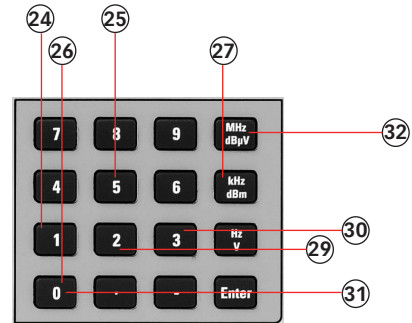
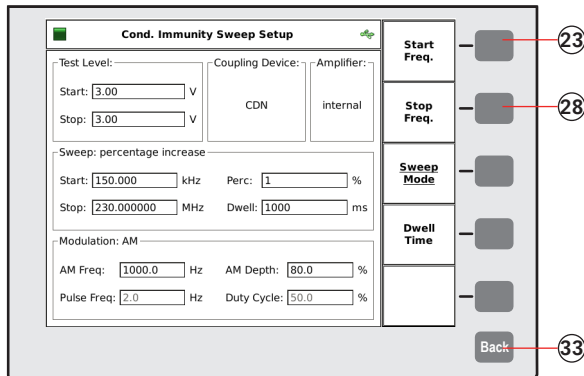
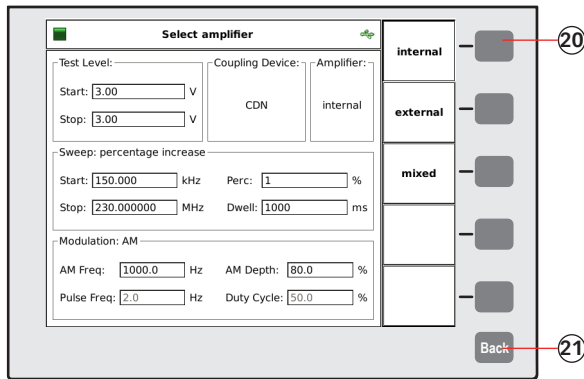


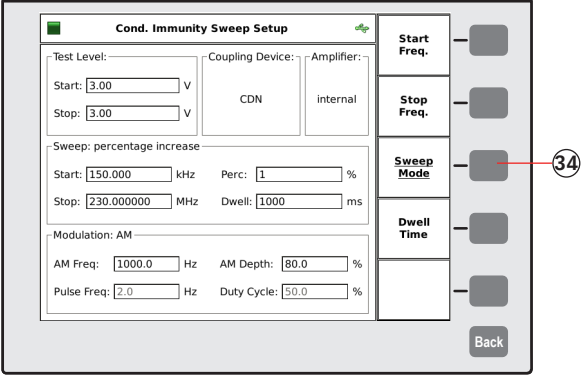
- 7. Press "TEST SETUP"
- 8. Press "TEST LEVEL"
- 9. Press "START"
- 10. Press "3"
- 11. Press "V" or "ENTER"
- 12. Press "STOP"
- 13. Press "3"
- 14. Press "V" or "ENTER"
- 15. Press "BACK"
- 16. Press "COUPLING DEVICE"
- 17. Press "CDN"
- 18. Press "BACK"



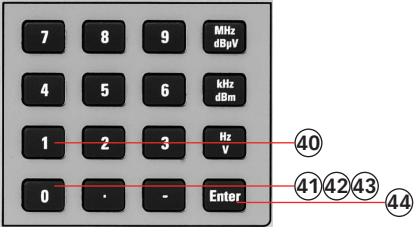
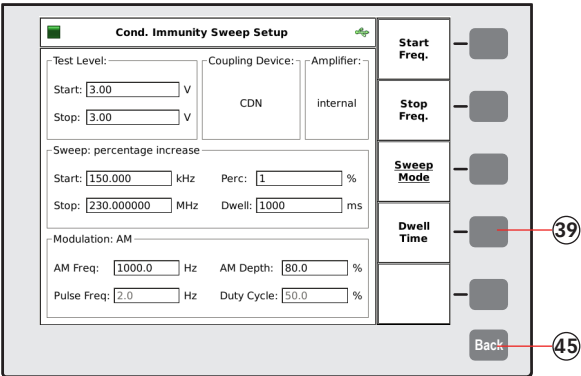
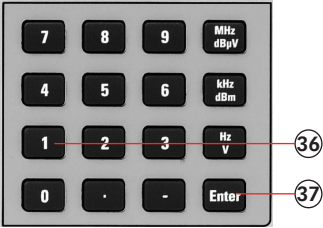
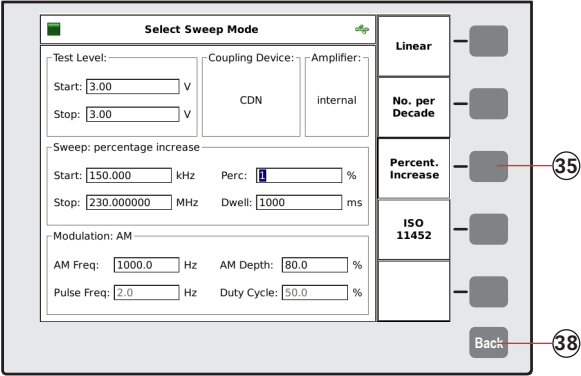


19. Press "AMPLIFIER"
20. Press "INTERNAL"
21. Press "BACK"
22. Press "SWEEP"
23. Press "START FREQ."
24. Press "1"
25. Press "5"
26. Press "0"
27. Press "kHz"
28. Press "STOP FREQ."
29. Press "2"
30. Press "3"
31. Press "0"
32. Press "MHZ"
33. Press "BACK"

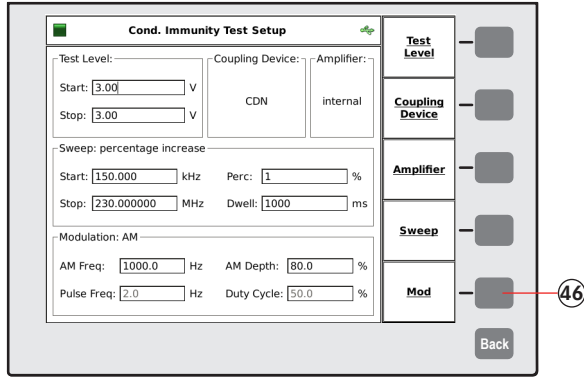




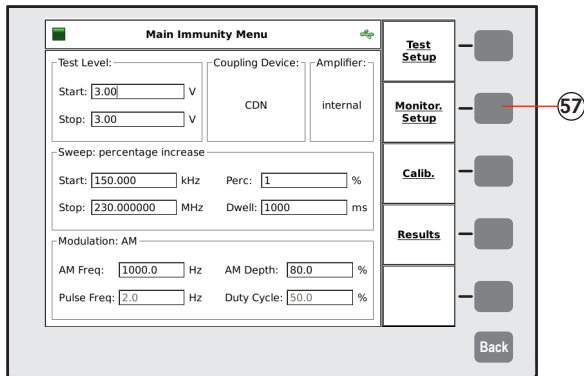
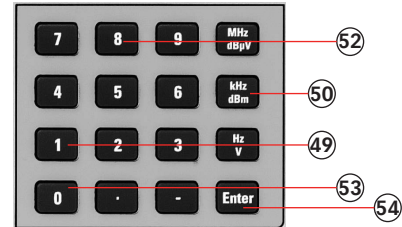
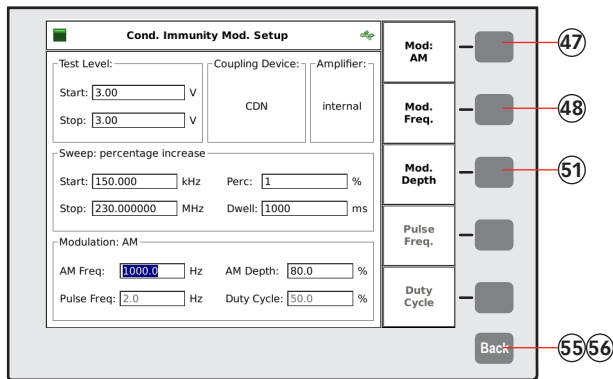
- 34. Press "SWEEP MODE"
- 35. Press "PERCENT. INCREASE"
- 36. Press "1"
- 37. Press "ENTER"
- 38. Press "BACK"
- 39. Press "DWELL TIME"
- 40. Press "1"
- 41. Press "0"
- 42. Press "0"
- 43. Press "0"
- 44. Press "ENTER"
- 45. Press "BACK"



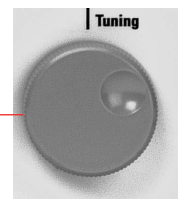
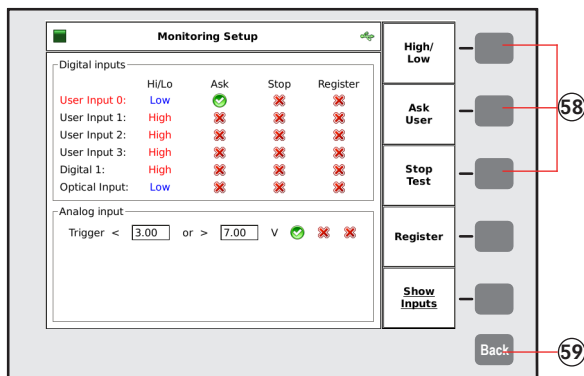


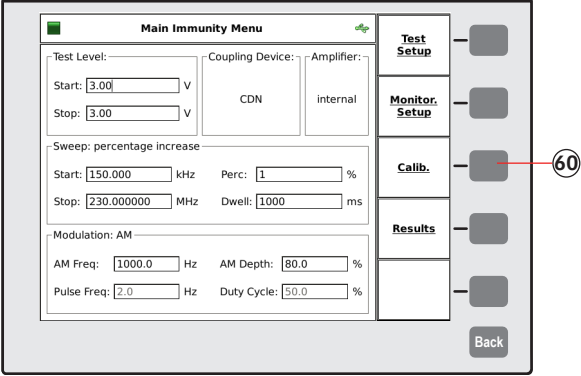


46. Press "MOD."
47. Press several times to have finally "MOD: AM" selected.
48. Press "MOD. FREQ"
49. Press "1"
50. Press "kHz"
51. Press "MOD. DEPTH"
52. Press "8"
53. Press "0"
54. Press "ENTER"
55. Press "BACK"
56. Press "BACK"

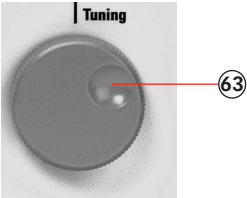
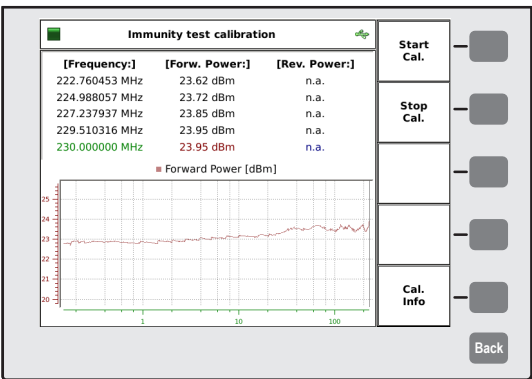
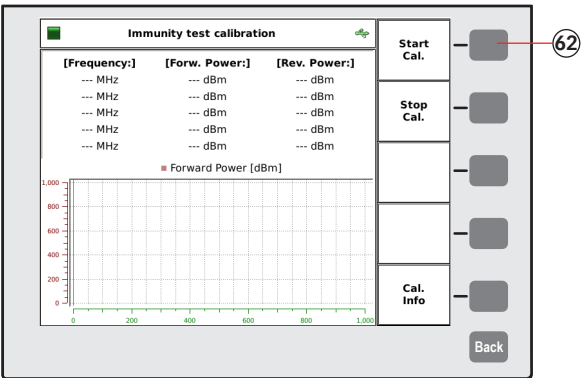
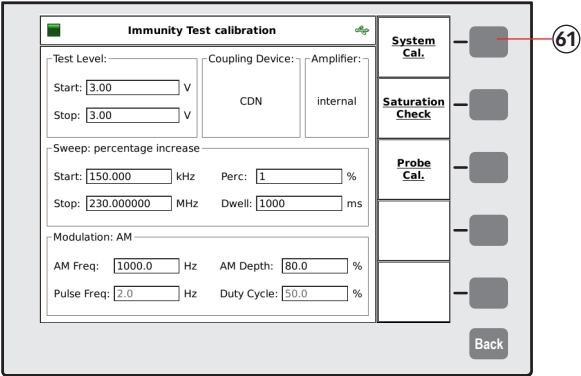


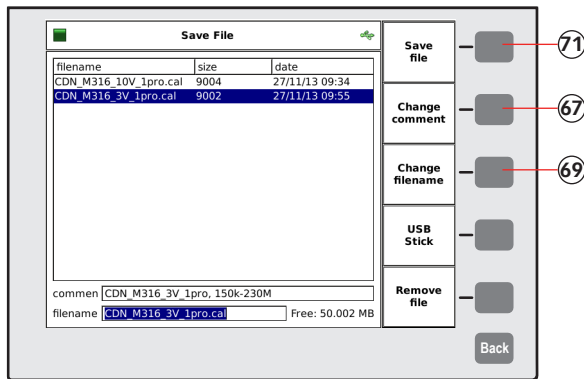
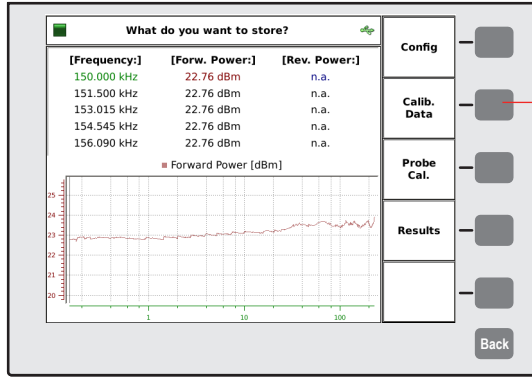
57. Press "MONITOR. SETUP"
58. Switch off all EUT monitoring ports for this example. Turn the knob to change the port and press the required softkey to select "X".
59. Press "BACK"



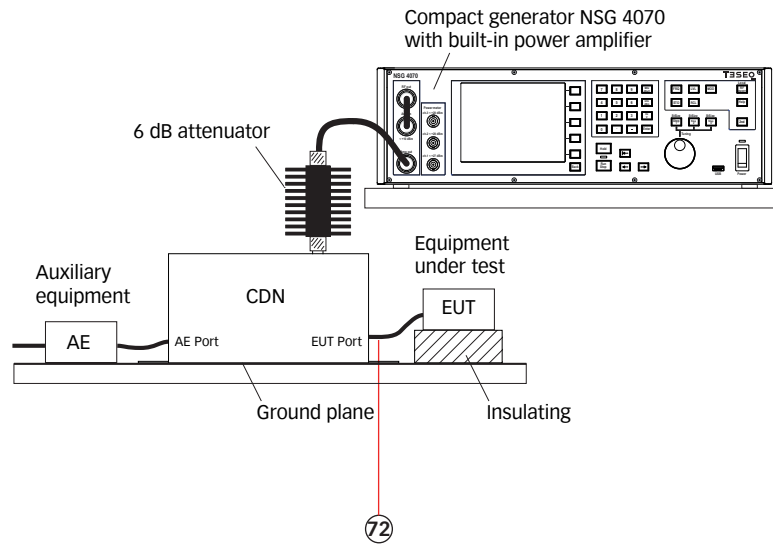
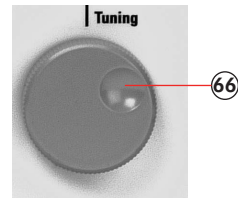


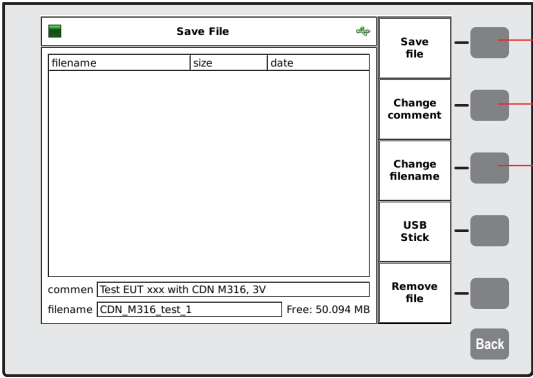
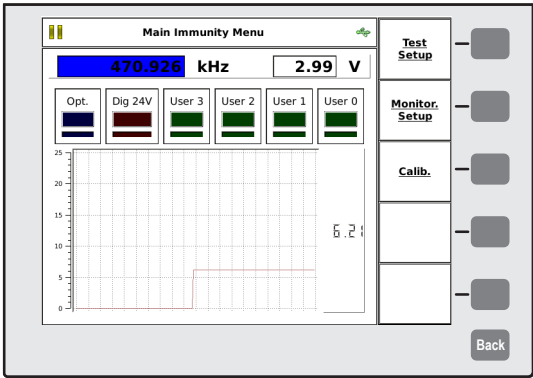
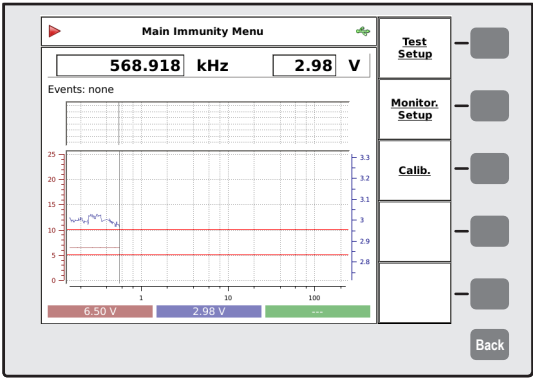
- 60. Press "CALIB."
- 61. Press "SYSTEM CAL."
- 62. Press "START CAL" and wait.
- 63. Turn the knob to check the calibration results. (optional)



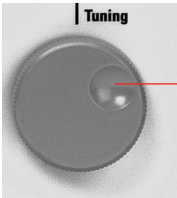


64. Press "STO" to store the calibration file or jump to step 73.
65. Press "CALIB. DATA"
66. Turn the knob to select a similar file comment or name. (optional)
67. Press "CHANGE COMMENT"
68. Type the comment on the connected keyboard.
69. Press "CHANGE FILENAME"
70. Type the name of the file on the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

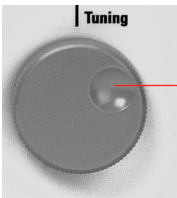




- 73. Press "RUN" to start the test.
- 74. Press "HOLD" to interrupt the sweep. (Caution! RF level is still present.)
- 75. Press "FRE" or "LEV" to select the test frequency or level.
- 76. Turn the knob to manually change the selected parameter.
- 77. Press "HOLD" to continue the test.

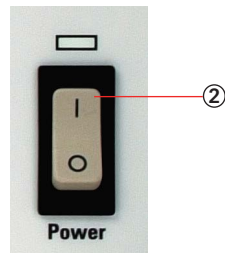
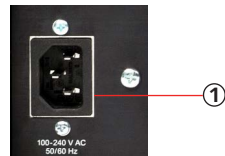


- 78. Press "STO" to store the result file.
- 79. Press "RESULTS"
- 80. Turn the knob to select a similar file comment or name. (optional)
- 81. Press "CHANGE COMMENT"
- 82. Type the comment on the connected keyboard.
- 83. Press "CHANGE FILENAME"
- 84. Type the name of the file on the connected keyboard.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

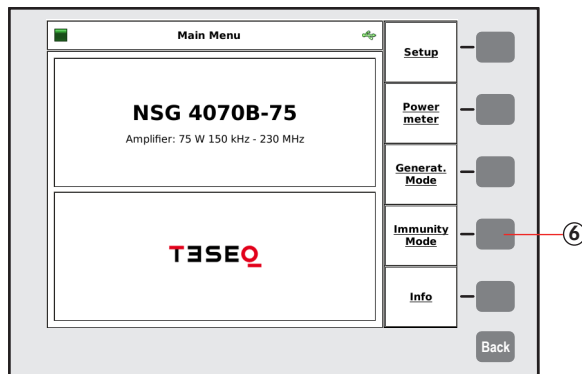
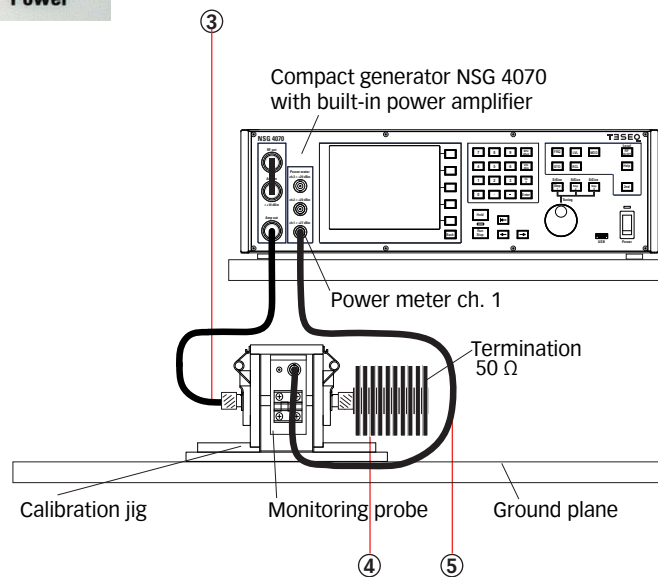


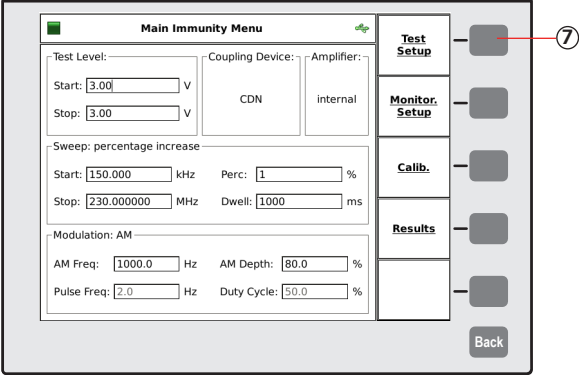
### 11.2. Example 2: Monitoring probe calibration for IEC/EN 61000-4-6

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 4070-35, NSG 4070-45 or NSG 4070-80. The probe must be inserted in a 50  $\Omega$  calibration jig. A termination and some RF cables are also required.

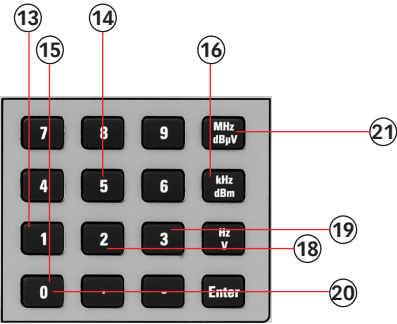
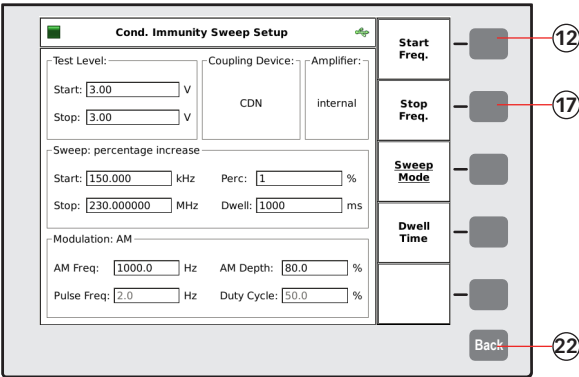
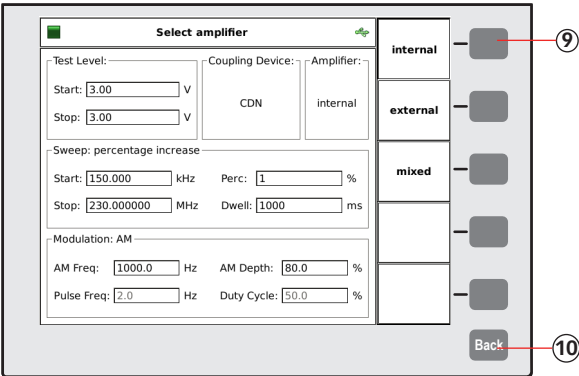
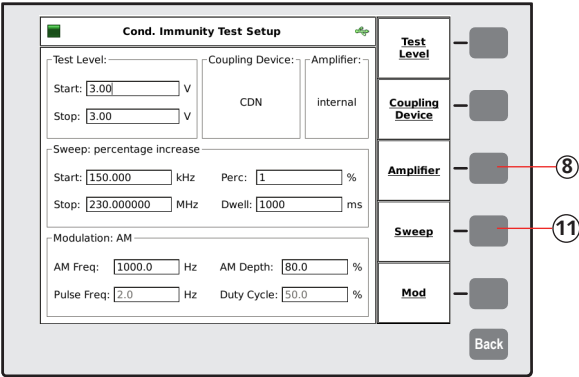


1. Connect the NSG 4070 with a suitable mains socket.
2. Switch the unit on.
3. Connect "AMP out" to the calibration jig.
4. Terminate one side of the calibration jig with 50  $\Omega$ .
5. Connect the monitoring probe output to the power meter channel 1.
6. Press "IMMUNITY MODE".

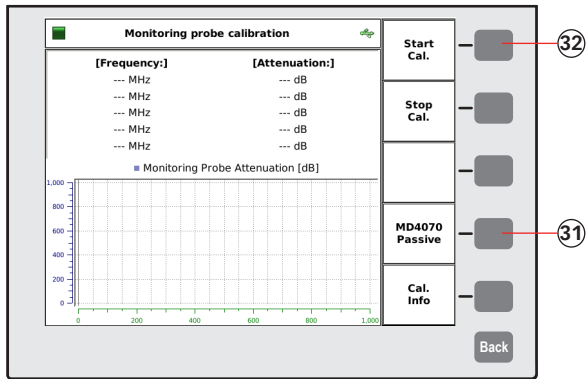




- 7. Press "TEST SETUP"
- 8. Press "AMPLIFIER"
- 9. Press "INTERNAL"
- 10. Press "BACK"
- 11. Press "SWEEP"
- 12. Press "START FREQ."
- 13. Press "1"
- 14. Press "5"
- 15. Press "0"
- 16. Press "kHz"
- 17. Press "STOP FREQ."
- 18. Press "2"
- 19. Press "3"
- 20. Press "0"
- 21. Press "MHZ"
- 22. Press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



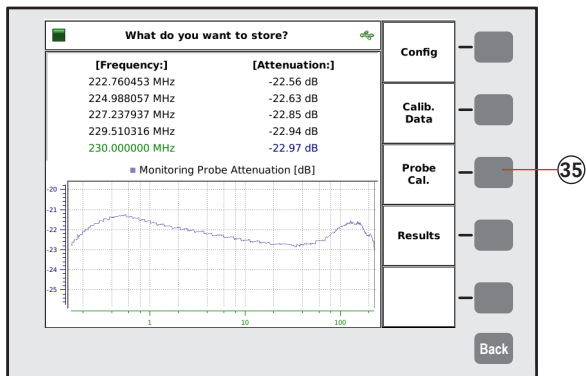
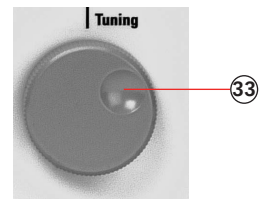
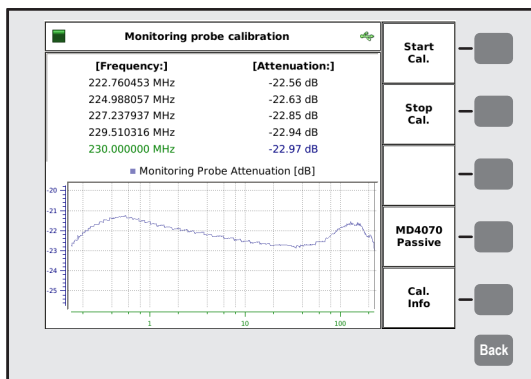
23. Press "SWEEP MODE"
24. Press "PERCENT. INCREASE"
25. Press "1"
26. Press "ENTER"
27. Press "BACK"
28. Press "BACK"
29. Press "CALIB."
30. Press "PROBE CAL."



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.

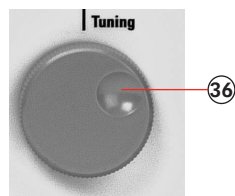
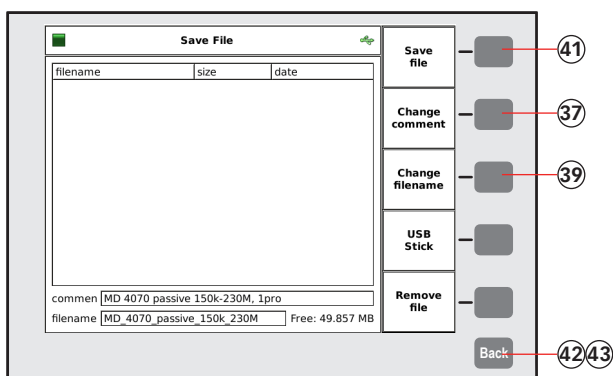
39. Press "CHANGE FILENAME"

40. Type the name of the file on the connected keyboard.

41. Press "SAVE FILE"

42. Press "BACK"

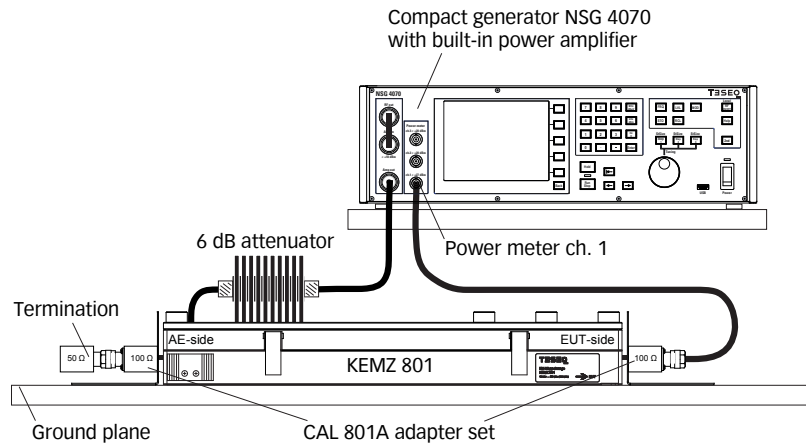
43. Press "BACK" (to reach the main menu)



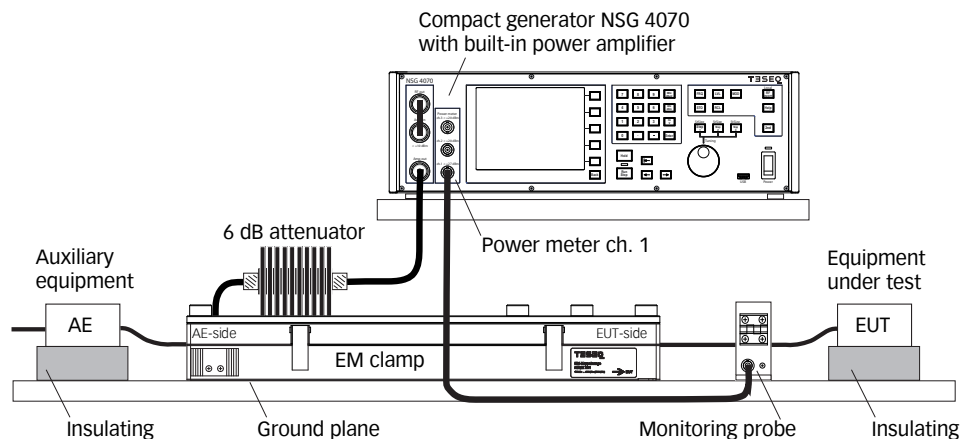


### 11.3. Example 3: IEC/EN 61000-4-6 testing with EM clamp and monitoring probe

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 4070-35, NSG 4070-45 or NSG 4070-80. 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.

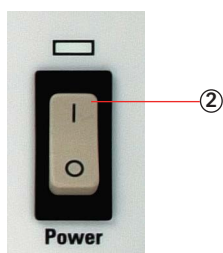
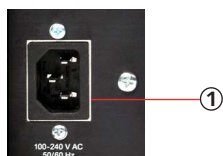


1. Connect the EM clamp as shown in the figure above.
2. Follow example 1 steps #1 to #72 with the exception of step #17. Select "EM CLAMP" and "WITH PROBE"
3. Follow example 2 steps #29 to #43.
4. Connect the EM clamp and monitoring probe as shown in the figure below.
5. Start the test as shown in example 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.)

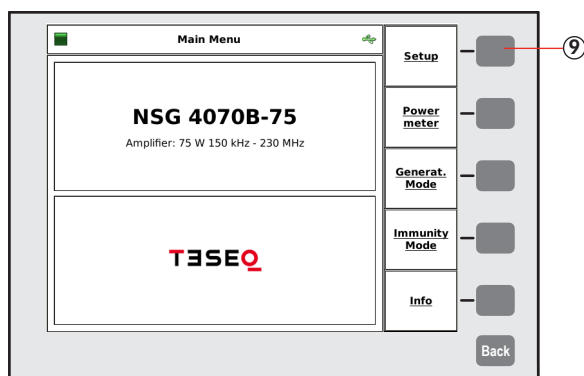
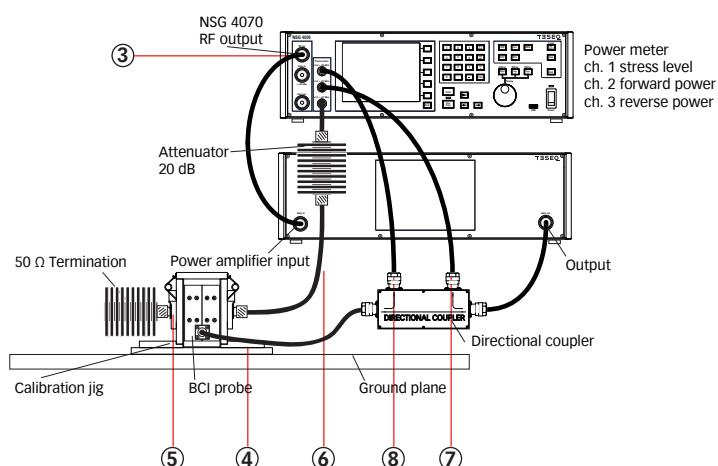


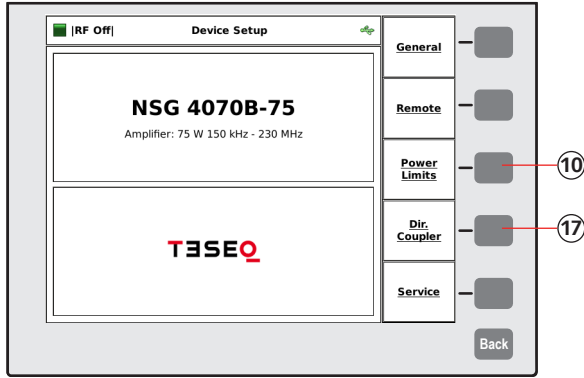
#### 11.4. Example 4: BCI testing

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.

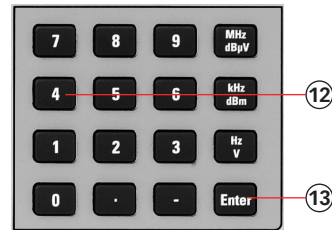
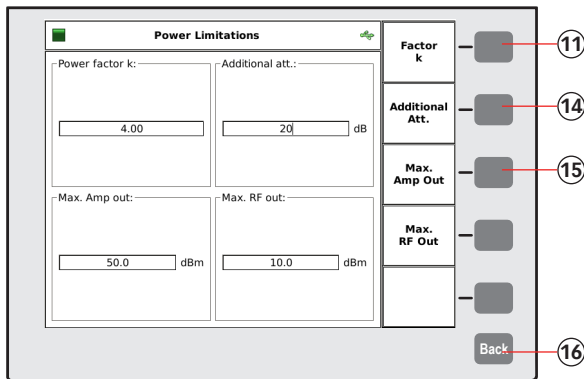


1. Connect the NSG 4070 with a suitable mains socket.
2. Switch the unit on.
3. Connect "RF out" to the power amplifier input.
4. Connect the output of the power amplifier to the BCI probe via the directional coupler.
5. Set up the calibration jig and termination as shown in the figure below.
6. Connect 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".

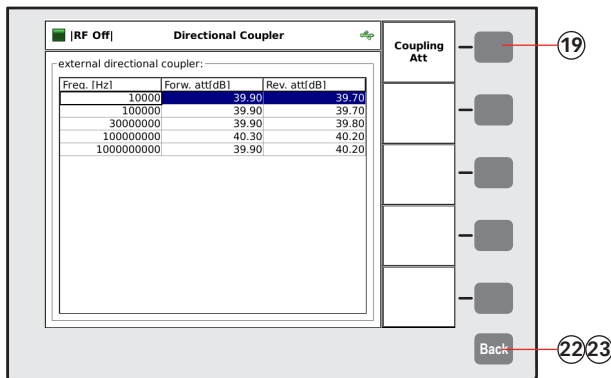




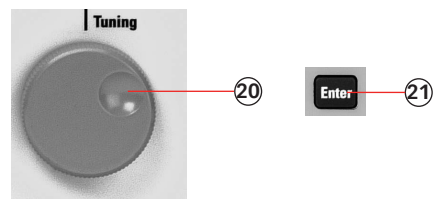
10. Press "POWER LIMITS"
11. Press "FACTOR K" (only needed for Closed Loop method)
12. Press "4"
13. Press "ENTER"

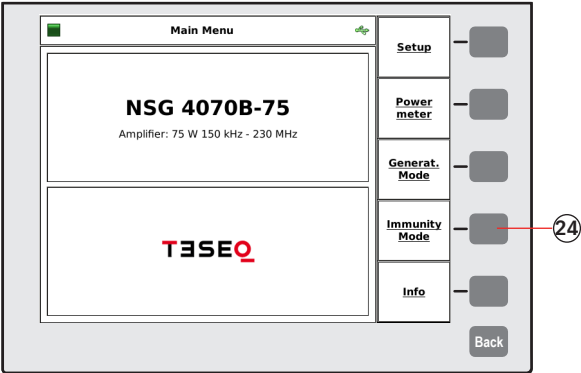


14. Press "ADDITIONAL ATT." and type in 20 in the case a 20 dB attenuator is used to protect power meter 1 (recommended for tests with  $\geq 100$  mA or  $\geq 100$   $\mu$ A).
15. Press "MAX. AMP OUT" and change this limit as required by the hardware.
16. Press "BACK"
17. Press "DIR. COUPLER"

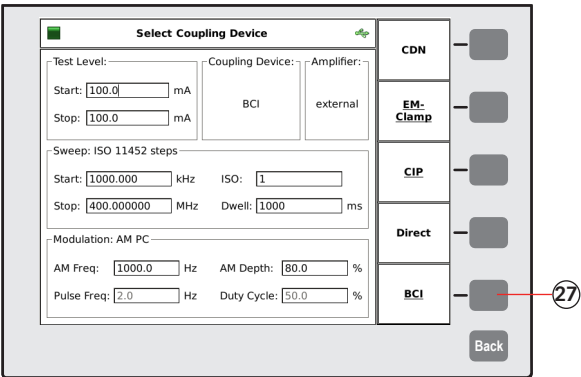
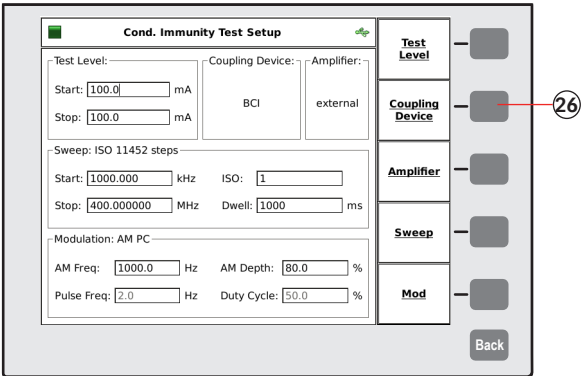
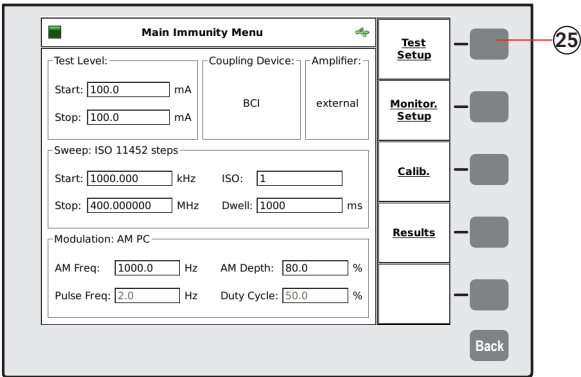


18. Insert the USB stick with the correction factors of the directional coupler and wait few seconds.
19. Press "COUPLING ATT."
20. Turn the knob to select the file.
21. Press "ENTER"
22. Press "BACK"
23. Press "BACK"



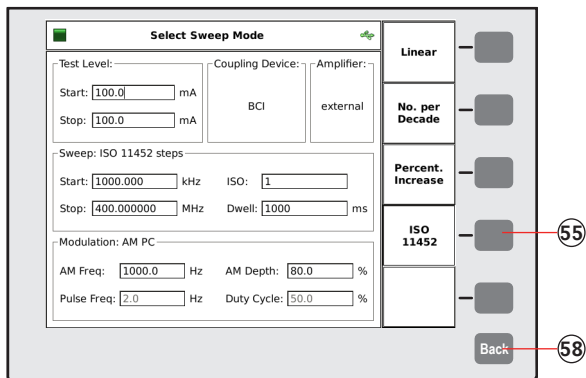


- 24. Press "IMMUNITY MODE"
- 25. Press "TEST SETUP"
- 26. Press "COUPLING DEVICE"
- 27. Press "BCI"



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"



**Select Sweep Mode**

Test Level: Start: 100.0 mA Stop: 100.0 mA

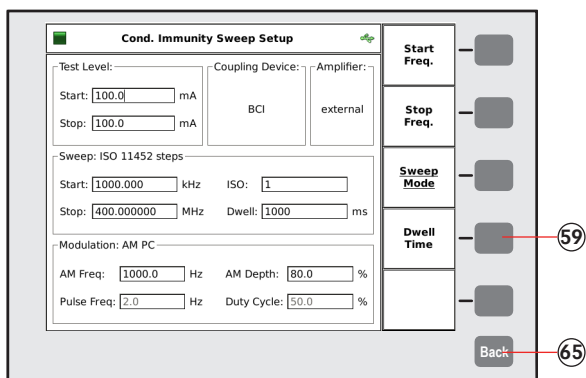
Coupling Device: BCI Amplifier: external

Sweep: ISO 11452 steps Start: 1000.000 kHz ISO: 1 Stop: 400.000000 MHz Dwell: 1000 ms

Modulation: AM PC AM Freq: 1000.0 Hz AM Depth: 80.0 % Pulse Freq: 2.0 Hz Duty Cycle: 50.0 %

Linear No. per Decade Percent. Increase ISO 11452 Back

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"



**Cond. Immunity Sweep Setup**

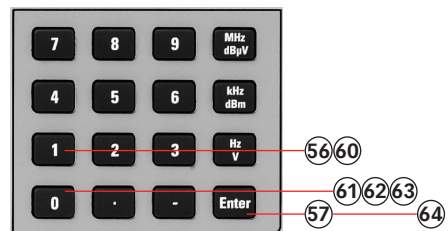
Test Level: Start: 100.0 mA Stop: 100.0 mA

Coupling Device: BCI Amplifier: external

Sweep: ISO 11452 steps Start: 1000.000 kHz ISO: 1 Stop: 400.000000 MHz Dwell: 1000 ms

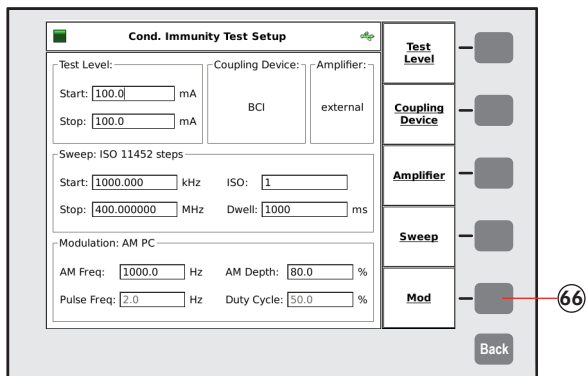
Modulation: AM PC AM Freq: 1000.0 Hz AM Depth: 80.0 % Pulse Freq: 2.0 Hz Duty Cycle: 50.0 %

Start Freq. Stop Freq. Sweep Mode Dwell Time Back



Keypad buttons: 7, 8, 9, MHz dBV, 4, 5, 6, kHz dBm, 1, 2, 3, Hz V, 0, ., -, Enter

Callouts: 56 (1), 60 (1), 61 (0), 62 (0), 63 (0), 57 (ENTER), 64 (BACK)



**Cond. Immunity Test Setup**

Test Level: Start: 100.0 mA Stop: 100.0 mA

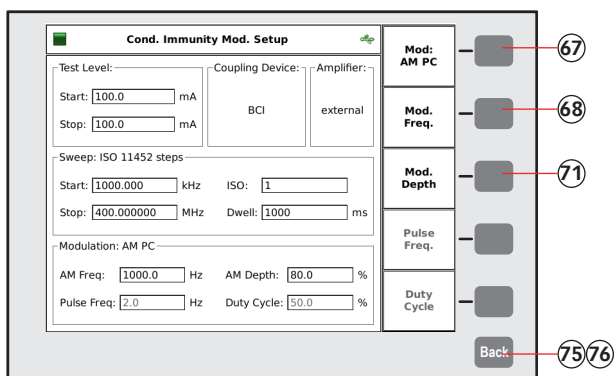
Coupling Device: BCI Amplifier: external

Sweep: ISO 11452 steps Start: 1000.000 kHz ISO: 1 Stop: 400.000000 MHz Dwell: 1000 ms

Modulation: AM PC AM Freq: 1000.0 Hz AM Depth: 80.0 % Pulse Freq: 2.0 Hz Duty Cycle: 50.0 %

Test Level Coupling Device Amplifier Sweep Mod 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"



**Cond. Immunity Mod. Setup**

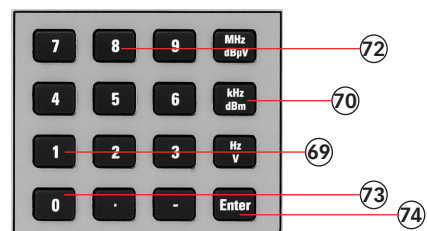
Test Level: Start: 100.0 mA Stop: 100.0 mA

Coupling Device: BCI Amplifier: external

Sweep: ISO 11452 steps Start: 1000.000 kHz ISO: 1 Stop: 400.000000 MHz Dwell: 1000 ms

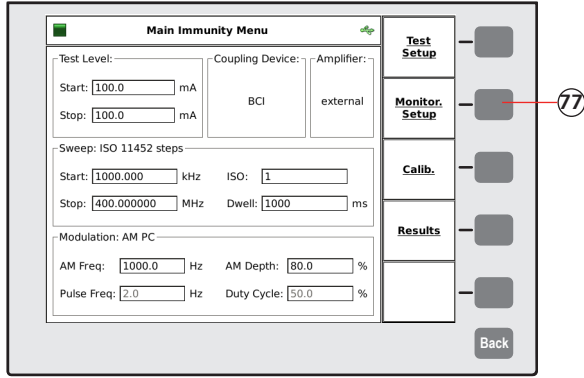
Modulation: AM PC AM Freq: 1000.0 Hz AM Depth: 80.0 % Pulse Freq: 2.0 Hz Duty Cycle: 50.0 %

Mod: AM PC Mod. Freq. Mod. Depth Pulse Freq. Duty Cycle Back

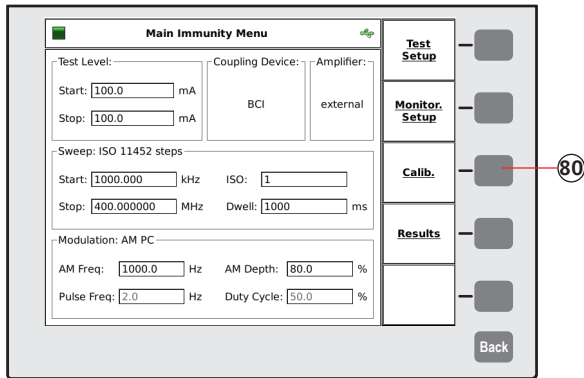
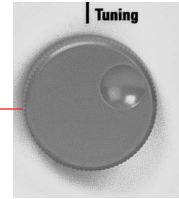
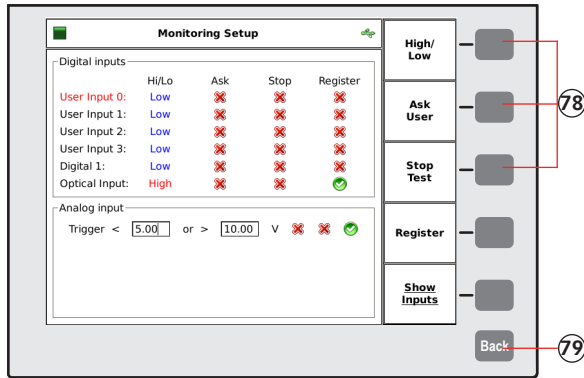


Keypad buttons: 7, 8, 9, MHz dBV, 4, 5, 6, kHz dBm, 1, 2, 3, Hz V, 0, ., -, Enter

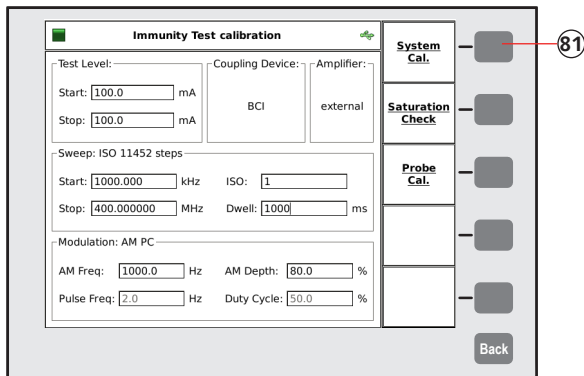
Callouts: 67 (AM PC), 68 (MOD. FREQ), 71 (MOD. DEPTH), 72 (8), 69 (1), 73 (0), 74 (ENTER)

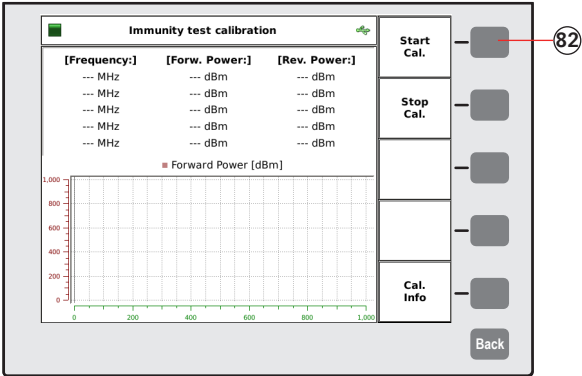


77. Press "MONITOR. SETUP"
78. Switch off all EUT monitoring ports for this example. Turn the knob to change the port and press the required softkey to select "X".
79. Press "BACK"

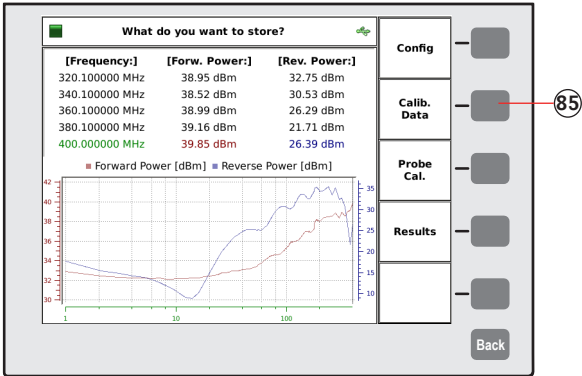
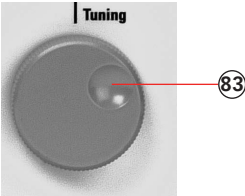
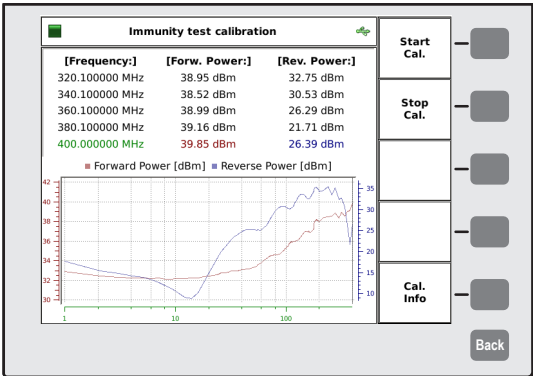


80. Press "CALIB."
81. Press "SYSTEM CAL."

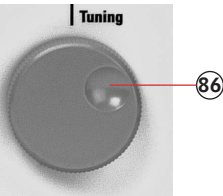
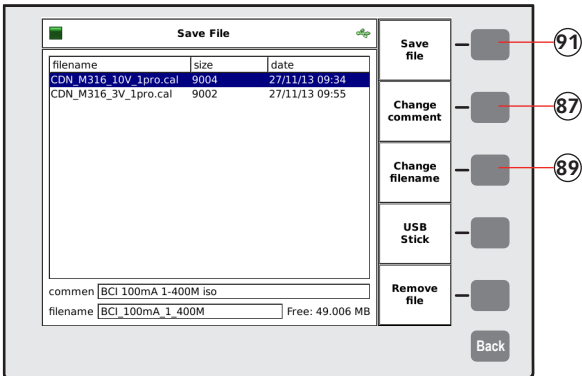




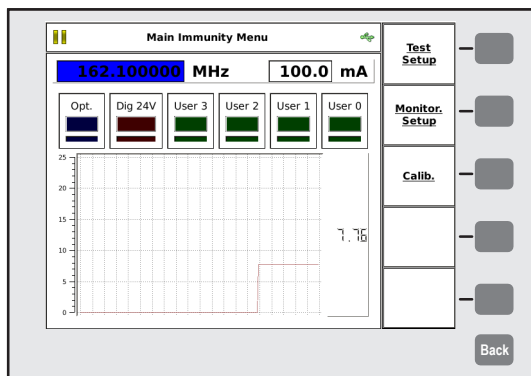
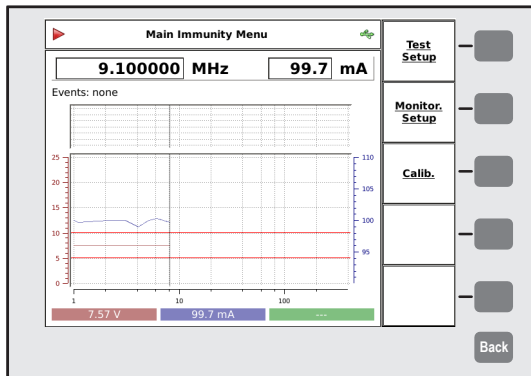
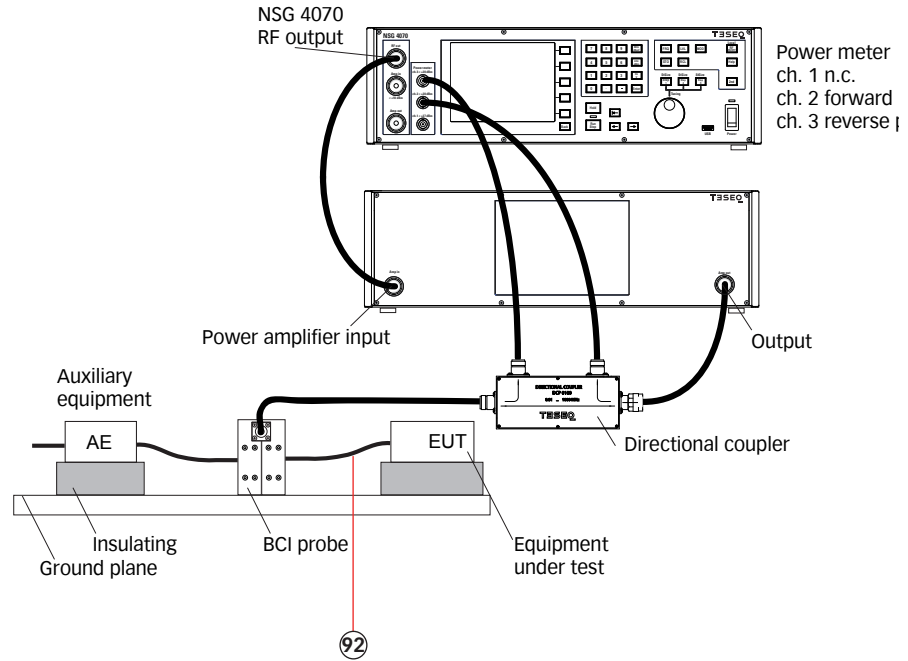
- 82. Press "START CAL." and wait.
- 83. Turn the knob to check the calibration results. (optional)



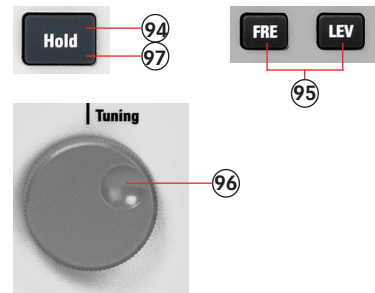
- 84. Press "STO" to store the calibration file or jump to step 92.
- 85. Press "CALIB. DATA"
- 86. Turn the knob to select a similar file comment or name. (optional)
- 87. Press "CHANGE COMMENT"
- 88. Type in the comment with the connected keyboard.
- 89. Press "CHANGE FILENAME"
- 90. Type in the name of the file with the connected keyboard.
- 91. Press "SAVE FILE"

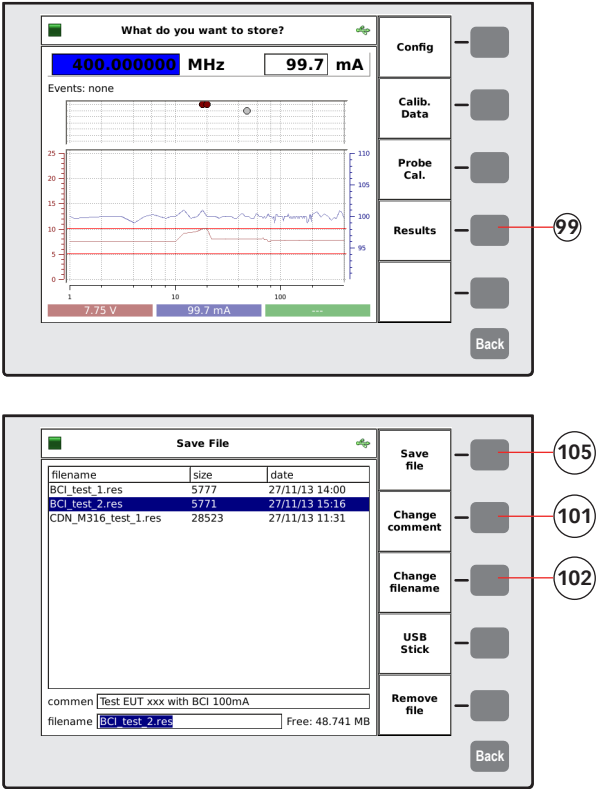




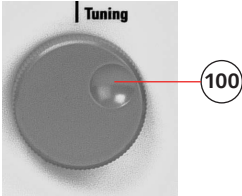


92. Remove the calibration jig and connect the EUT.
93. Press "RUN" to start the test.
94. Press "HOLD" to interrupt the sweep. (Caution! RF level is still present.)
95. Press "FRE" or "LEV" to select the test frequency or level.
96. Turn the knob to manually change the selected parameter.
97. Press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



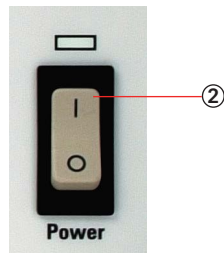
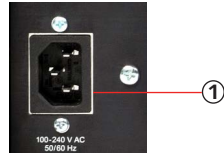


- 98. Press "STO" to store the result file.
- 99. Press "RESULTS"
- 100. Turn the knob to select a similar file comment or name. (optional)
- 101. Press "CHANGE COMMENT"
- 102. Type in the comment with the connected keyboard.
- 103. Press "CHANGE FILENAME"
- 104. Type in the name of the file with the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

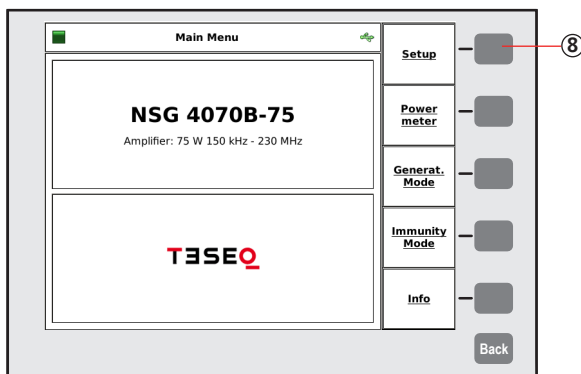
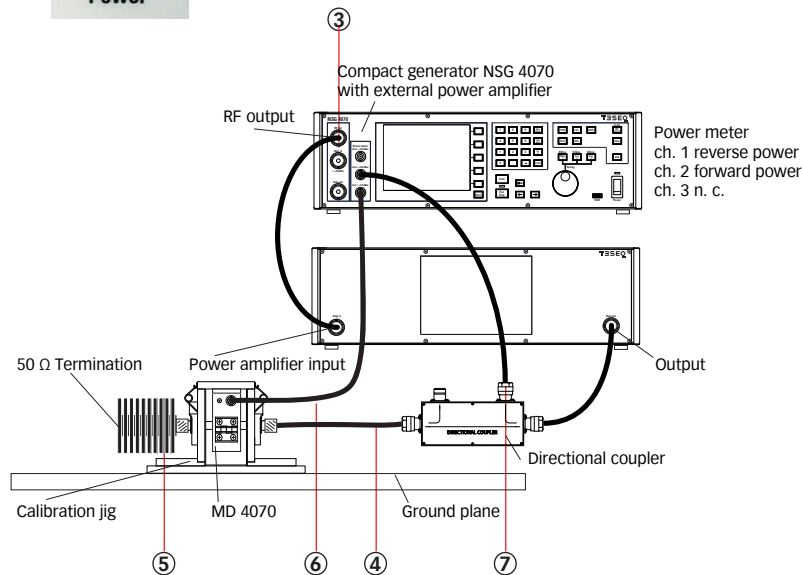


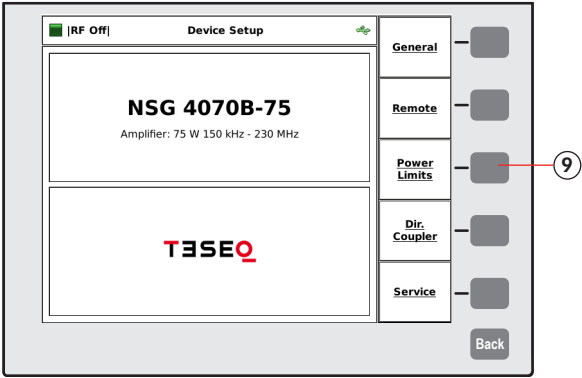
### 11.5. Example 5: Monitoring probe calibration for BCI

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  $\Omega$  calibration jig.

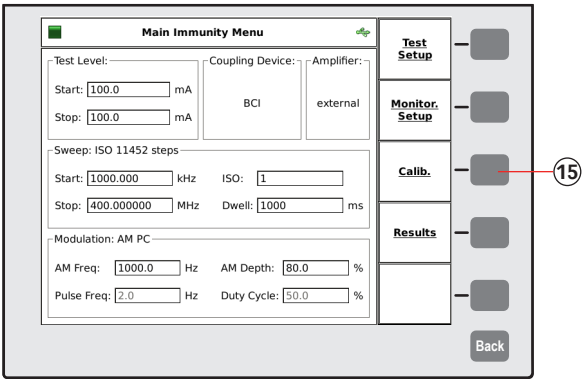
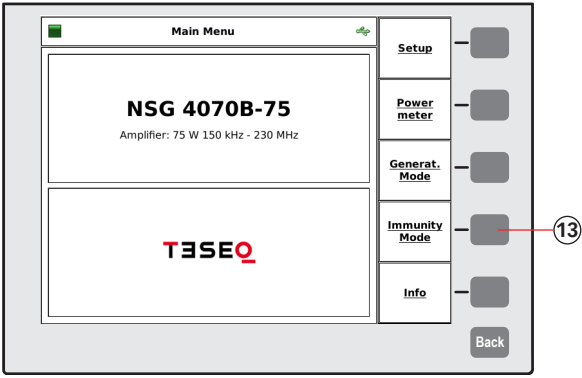
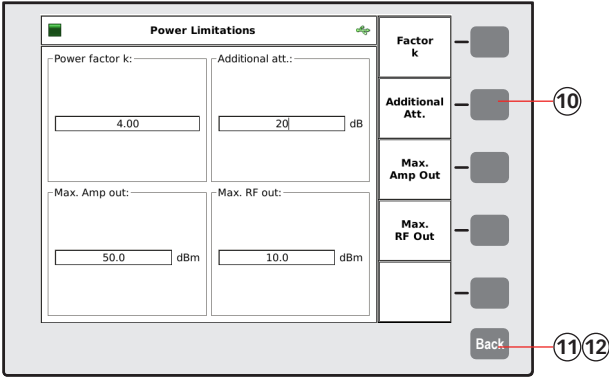


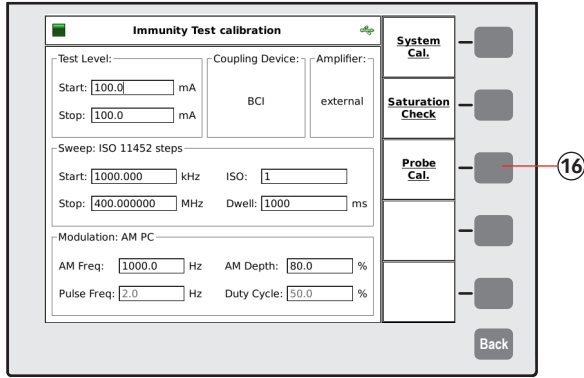
1. Connect the NSG 4070 with a suitable mains socket.
2. Switch the unit on.
3. Connect "RF out" to the power amplifier input.
4. Connect the output of the power amplifier via the directional coupler to the calibration jig.
5. Terminate the calibration jig as shown in the figure below.
6. Connect the 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. Press "SETUP".



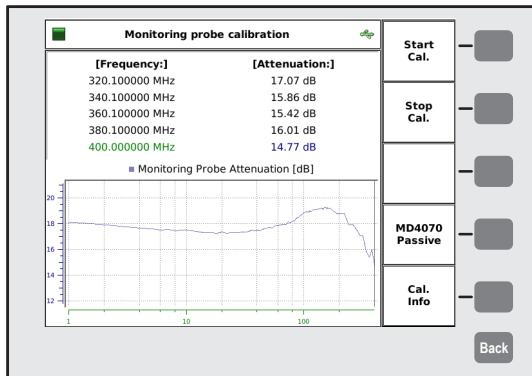
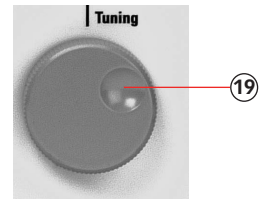
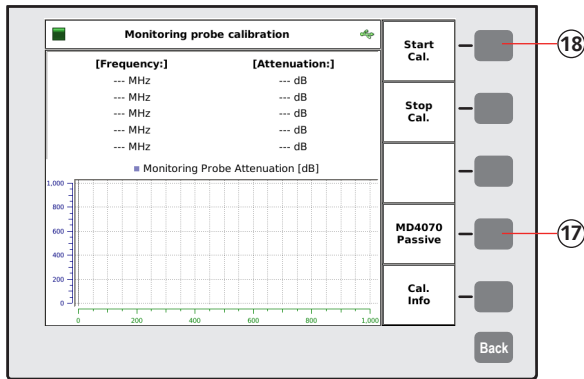


- 9. Press "POWER LIMITS"
- 10. Press "ADDITIONAL ATT." and change this value to 0. (No attenuator is required to protect power meter 1 for probe calibration).
- 11. Press "BACK"
- 12. Press "BACK" (to reach the main menu)
- 13. Press "IMMUNITY MODE".
- 14. Follow example 4 steps #25 to #58 to specify the test parameters in case example 4 wasn't performed right before.
- 15. Press "CALIB."

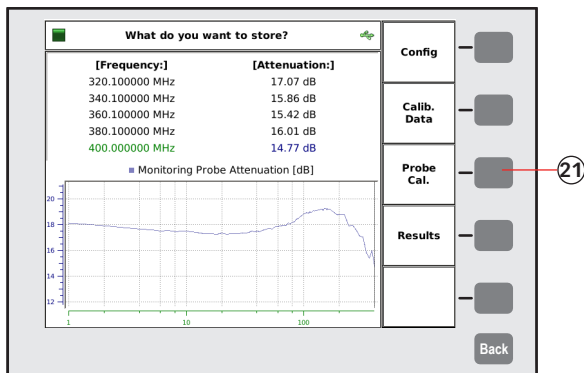


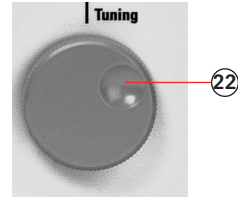
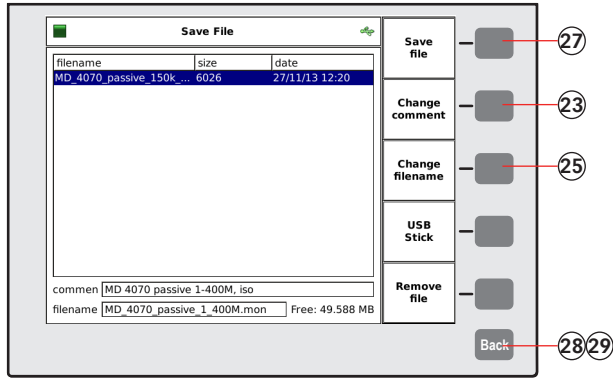


16. Press "PROBE CAL."
17. Select "MD4070 PASSIVE" if using MD 4070 passive with remote connection. Select "MD4070 ACTIVE" if using MD 4070 active with remote connection.
18. Press "START CAL." and wait.
19. Turn the knob to check the calibration results. (optional)



20. Press "STO" to store the calibration file.
21. Press "PROBE CAL."

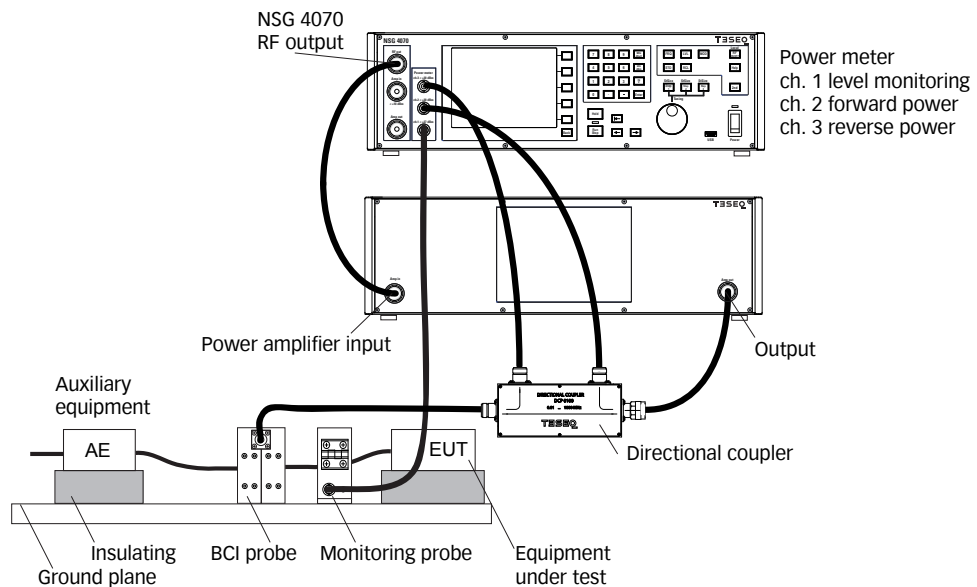




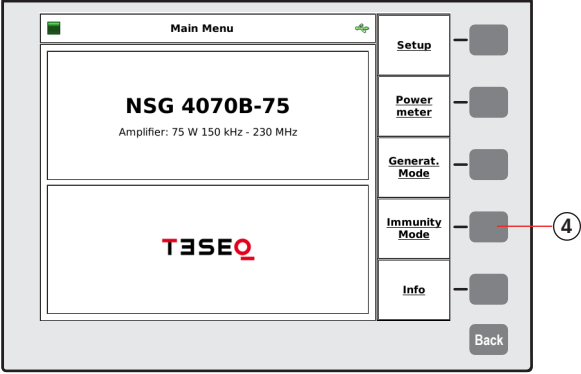
22. Turn the knob to select a similar file comment or name. (optional)
23. Press "CHANGE COMMENT"
24. Type the comment on the connected keyboard.
25. Press "CHANGE FILENAME"
26. Type the name of the file on the connected keyboard.
27. Press "SAVE FILE"
28. Press "BACK"
29. Press "BACK" (to reach the main menu)

### 11.6. Example 6: BCI testing with monitoring probe

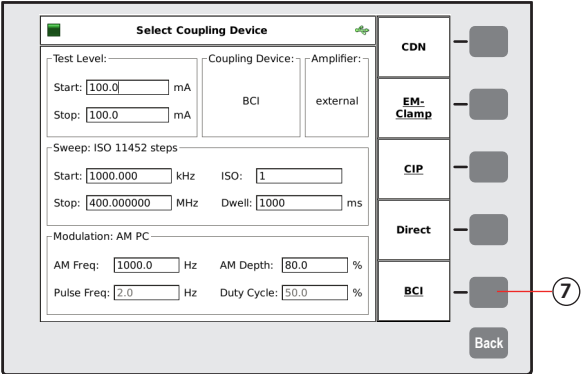
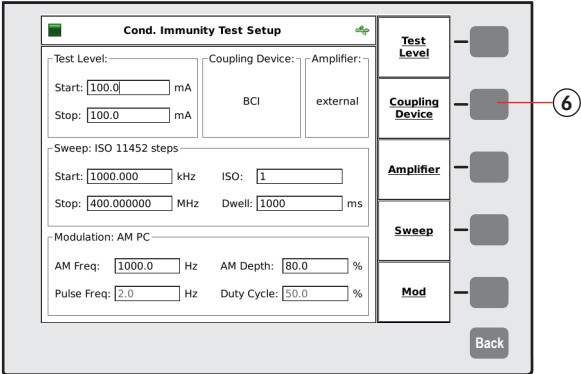
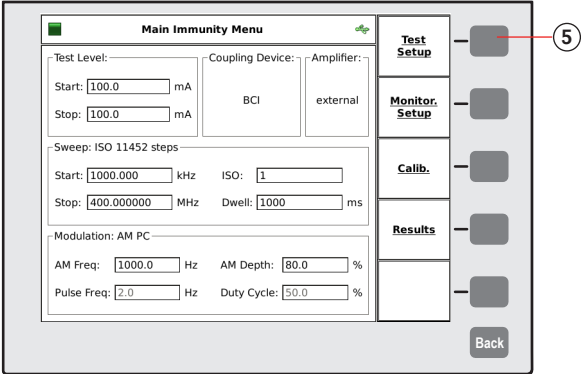
The following example is based on examples 4 and 5 (chapter 11.4 and 11.5). This example requires a NSG 4070, external directional coupler, external power amplifier, BCI probe and monitoring probe.

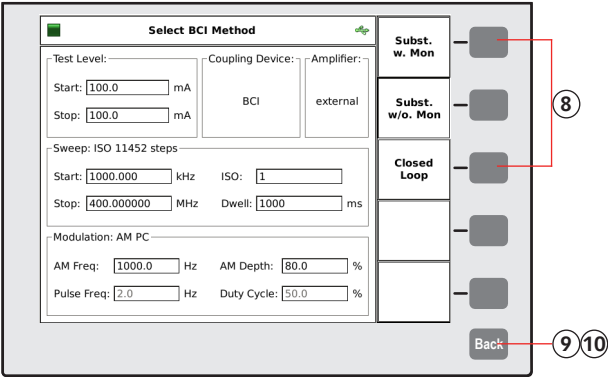


1. Connect the BCI probe and monitoring probe as shown in the figure above.
2. Follow example 4 steps #1 to #91 and press 2 x "BACK" (to reach the "MAIN IMMUNITY MENU")
3. Follow example 5 steps #1 to #23 and press "BACK" (to reach the "MAIN MENU" for this example)

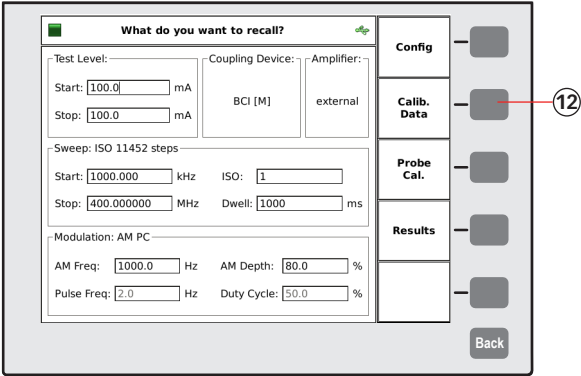


- 4. Press "IMMUNITY MODE"
- 5. Press "TEST SETUP"
- 6. Press "COUPLING DEVICE"
- 7. Press "BCI"

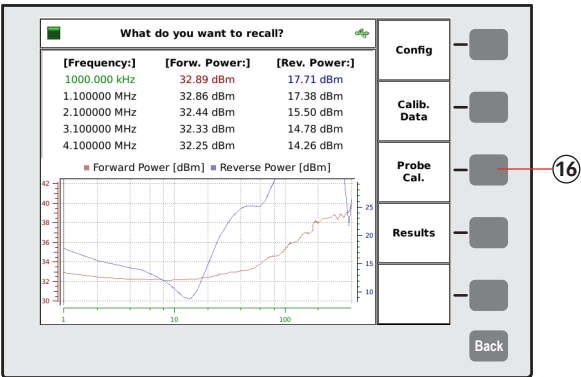
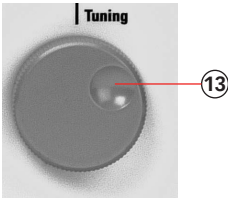
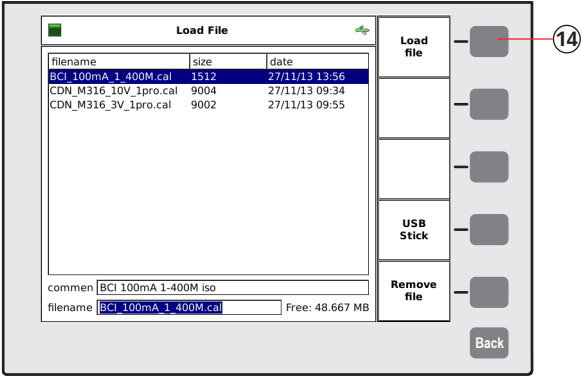




- 8. Press "SUBST. W MON." or "CLOSED LOOP" to test with monitoring probe.
- 9. Press "BACK"
- 10. Press "BACK"

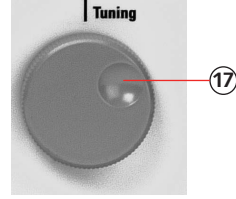
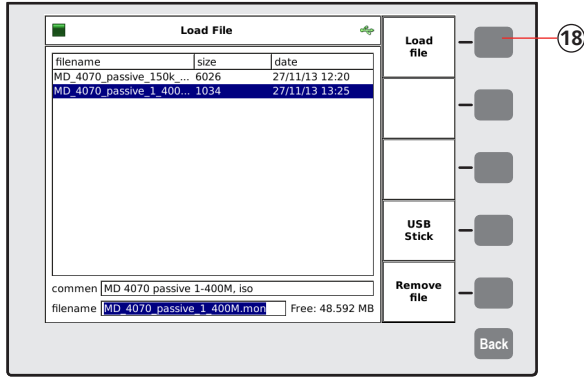


- 11. Press "RCL" to recall the system calibration file (optional if calibrated just before, jump to step #15).
- 12. Press "CALIB. DATA"
- 13. Turn the knob to select the file.
- 14. Press "LOAD FILE"

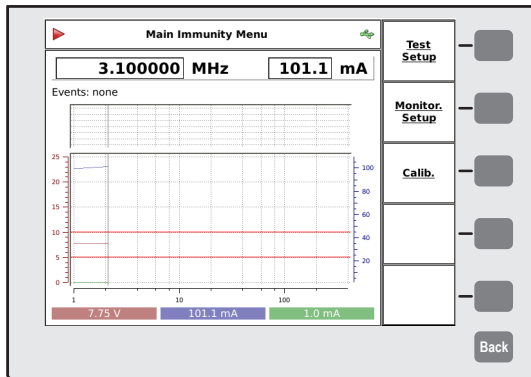


- 15. Press "RCL" to recall the probe calibration file (optional if calibrated just before, jump to step #19).
- 16. Press "PROBE CAL."

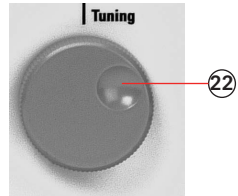
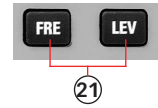
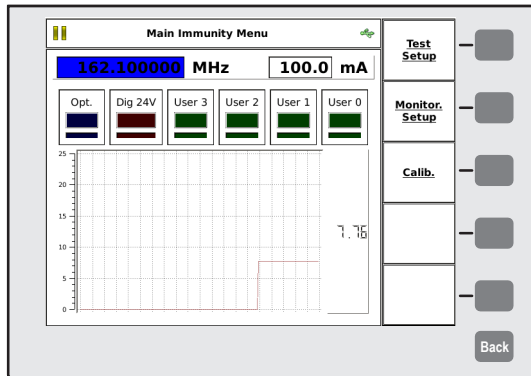


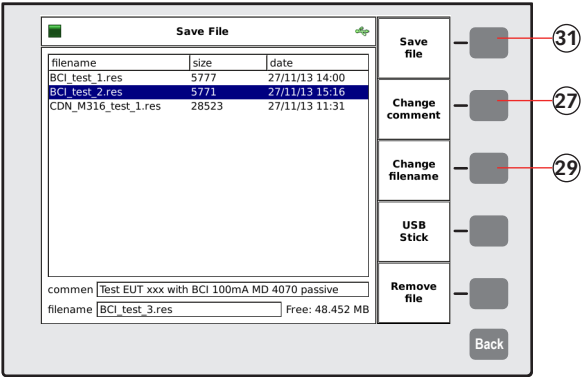
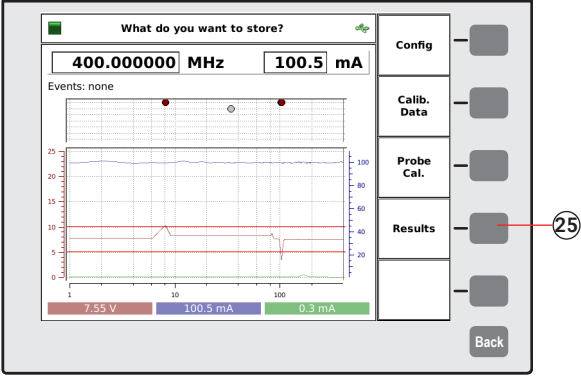


17. Turn the knob to select the file.
18. Press "LOAD FILE"

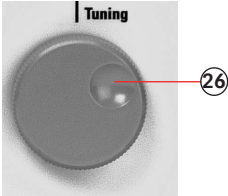


19. Press "RUN" to start the test.
20. Press "HOLD" to interrupt the sweep. (Caution! RF level is still present.)
21. Press "FRE" or "LEV" to select the test frequency or level.
22. Turn the knob to manually change the selected parameter.
23. Press "HOLD" to continue the test.



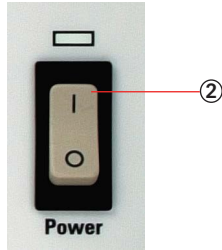
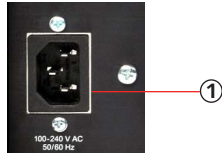


- 24. Press "STO" to store the result file.
- 25. Press "RESULTS"
- 26. Turn the knob to select a similar file comment or name. (optional)
- 27. Press "CHANGE COMMENT"
- 28. Type the comment on the connected keyboard.
- 29. Press "CHANGE FILENAME"
- 30. Type the name of the file on the connected keyboard.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

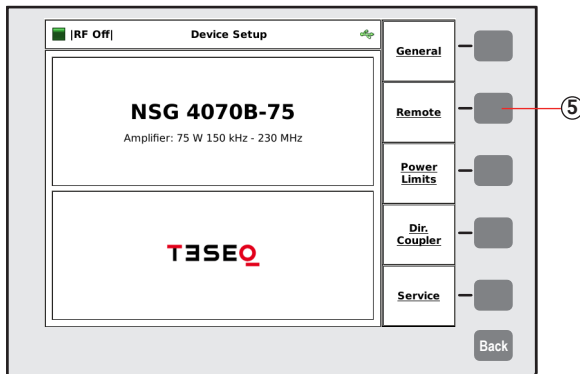
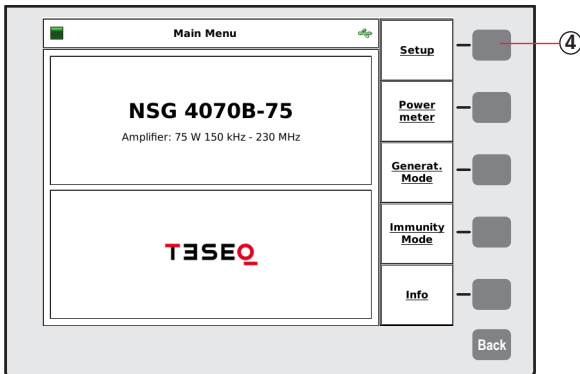
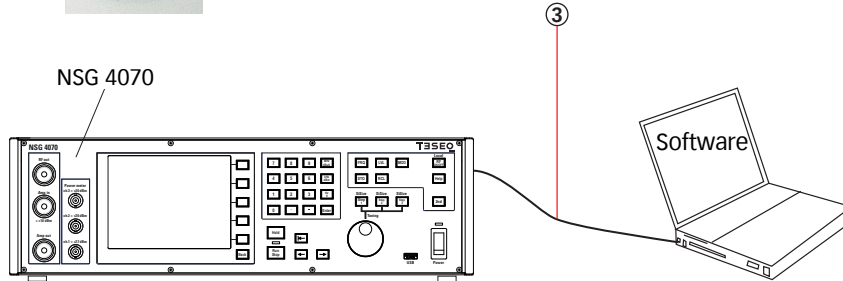


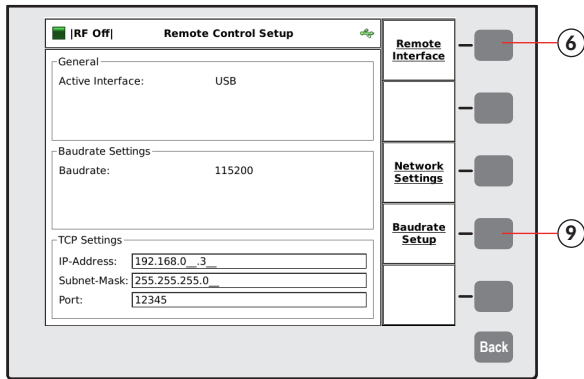
### 11.7. Example 7: Initiating the NSG 4070 control program

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.

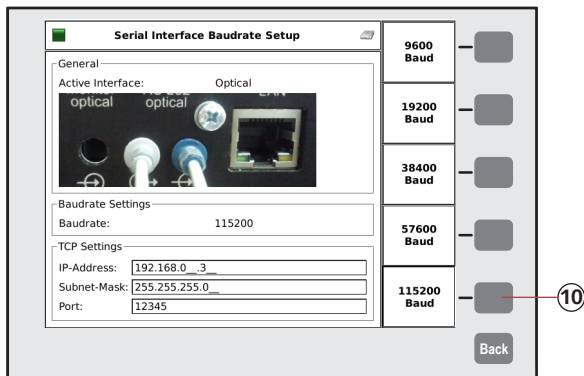
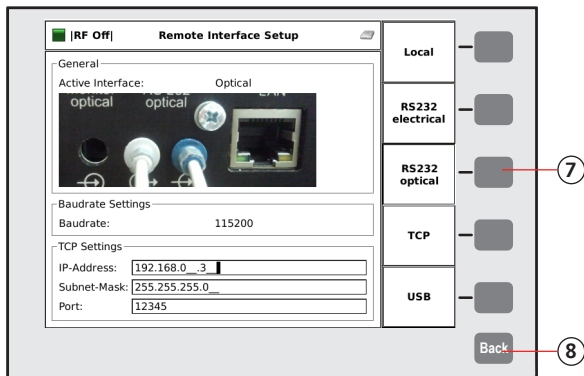


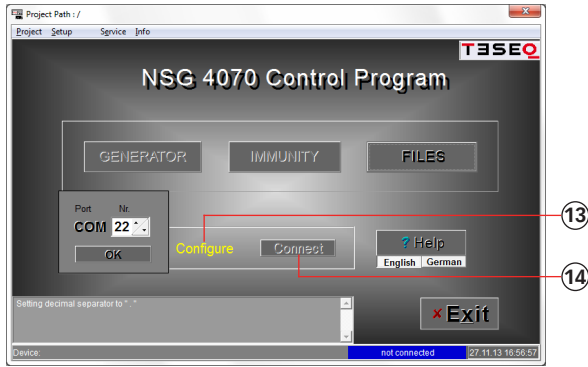
1. Connect the NSG 4070 with a suitable mains socket.
2. Switch the unit on.
3. Connect "LAN" to the PC with installed "NSG 4070 CONTROL PROGRAM"
4. Press "SETUP".
5. Press "REMOTE".





6. Press "REMOTE INTERFACE".
7. Press "RS232 OPTICAL".
8. Press "BACK"
9. Press "BAUDRATE SETUP"
10. Change the settings as required.  
(Default value is 11500 Baud)
11. Connect the NSG 4070 and USO 4013  
as shown in the figure.
12. Start the NSG 4070 Control Program  
and click several times to select USB.

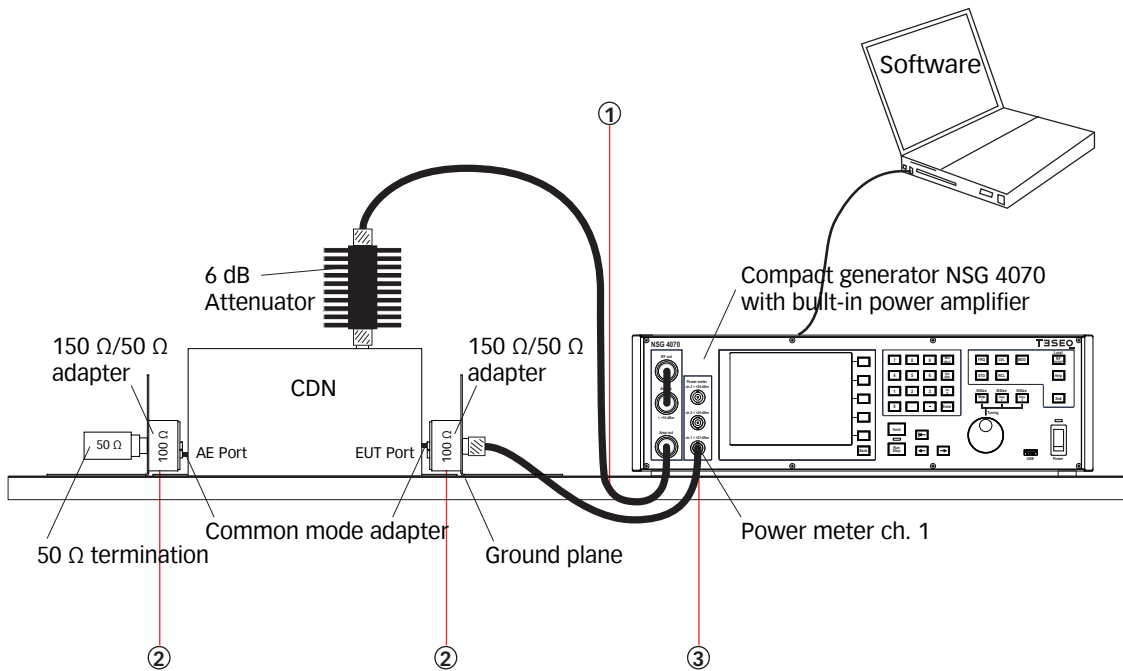




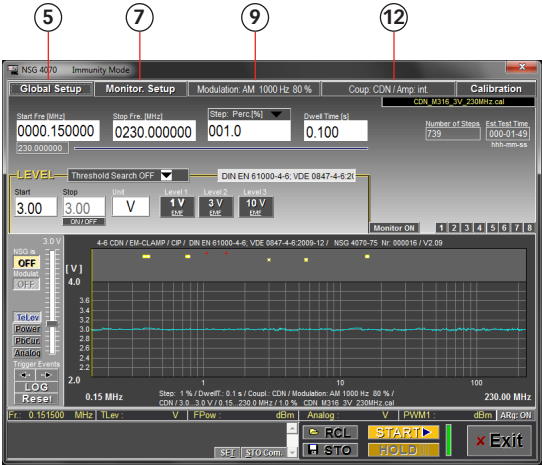
13. Click "CONFIGURE" and select the COM port as given for the already connected and working USO 4013.
14. Click "CONNECT".

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

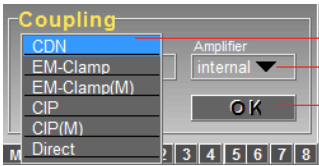
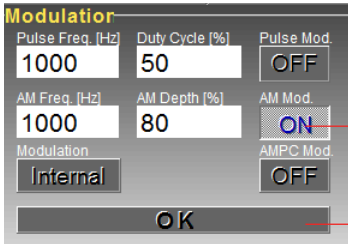
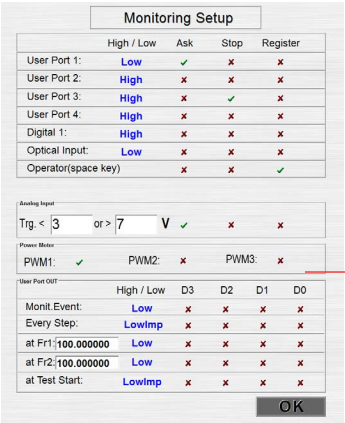
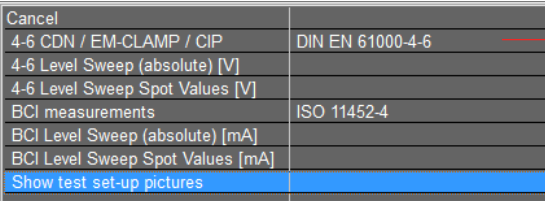
The following example shows the remote operation of the NSG 4070 for testing according IEC/EN 61000-4-6 with CDNs. This example requires a NSG 4070 with a built-in power amplifier, like the NSG 4070-35, NSG 4070-45 or NSG 4070-80. The CDN must be supplied with calibration adapters for level setting. A 6 dB attenuator and some RF cables are also required.

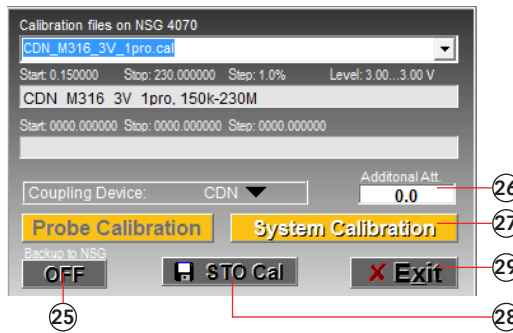
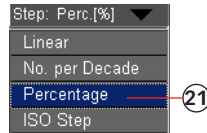
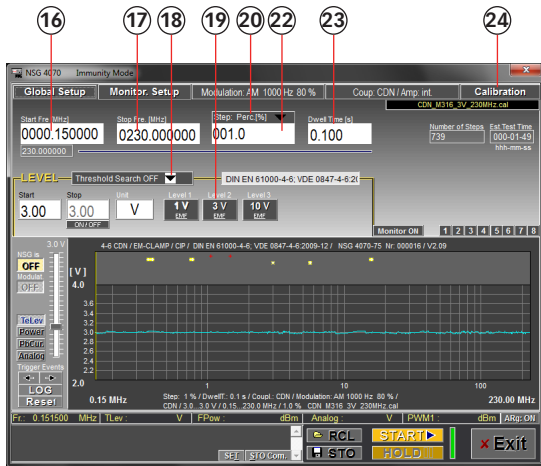


1. Connect "AMP out" to the 6 dB attenuator and the CDN.
2. Set up the CDN calibration adapters as shown in the CDN operating instructions.
3. Connect the 150/50 Ω adapter to the power meter channel 1.
4. Click "IMMUNITY".

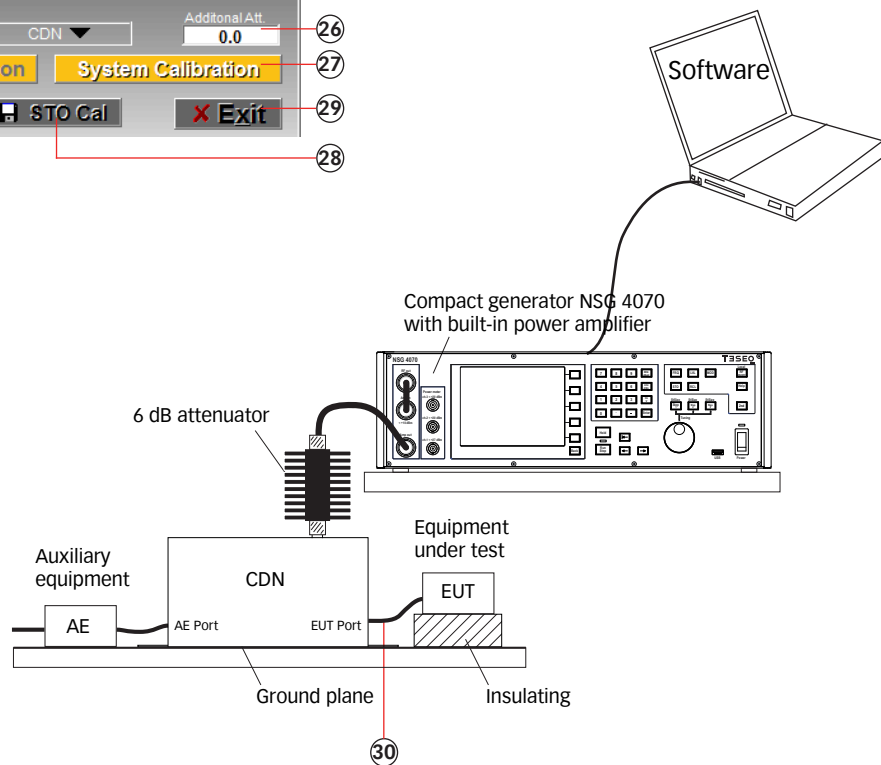


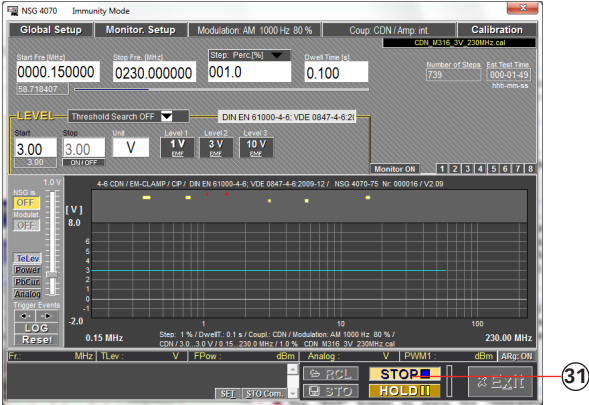
- 5. Click "GLOBAL SETUP".
- 6. Select "4-6 CDN / EM CLAMP / CIP".
- 7. Click "MONITOR. SETUP".
- 8. Switch off all EUT monitoring ports for this example. Click to change and select "X".
- 9. Click "MODULATION ...".
- 10. Change to 1000 Hz, 80% and AM.
- 11. Click "OK".
- 12. Click "COUP: CDN ...".
-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



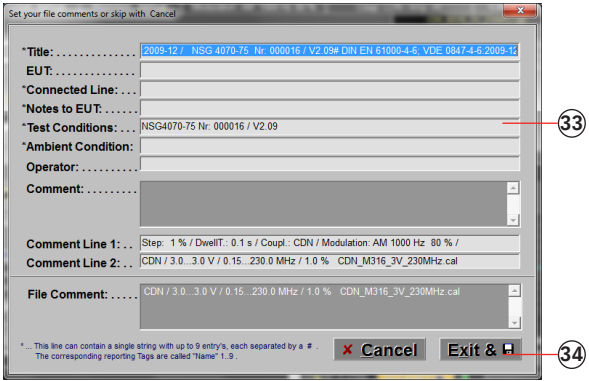
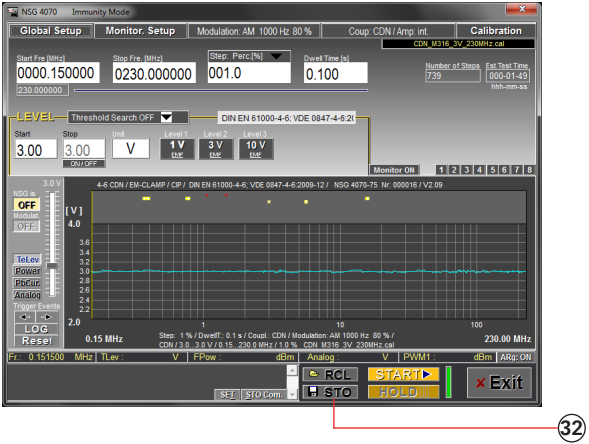


16. Change the "START FREQ." to "0.150".
17. Change the "STOP FREQ." to "230".
18. Select "THRESHOLD SEARCH OFF".
19. Click "3 V EMF".
20. Click "STEP:.....".
21. Select "PERCENTAGE".
22. Change the "STEP SIZE" to "1.0".
23. Change the "DWELL TIME" to "1.0".
24. Click "CALIBRATION".
25. Click "BACKUP 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.





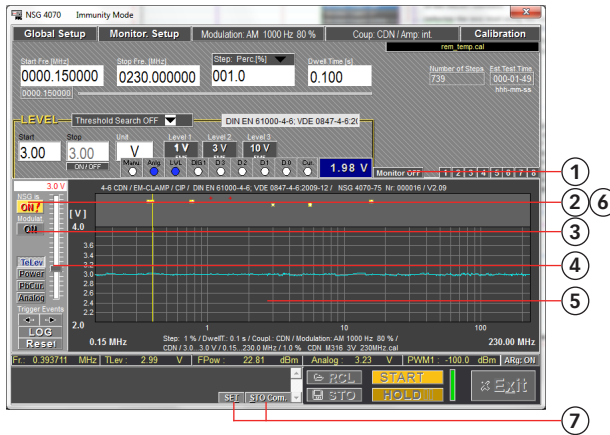
- 31. Click "START" and wait until test is finished.
- 32. Click "STO".
- 33. Fill out the test comments.
- 34. Click "EXIT & STORE" to store the results on the PC. A second window allows the user to change the path and file name.





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

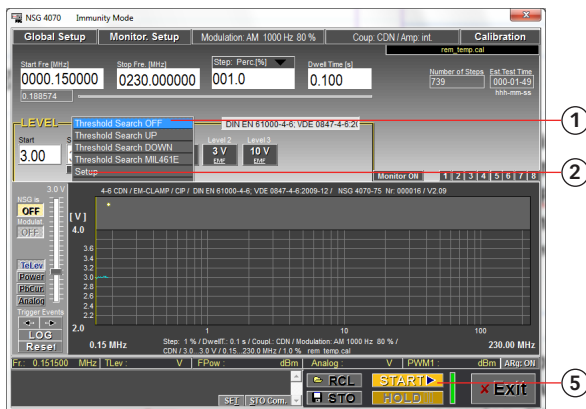
The following example shows the remote operation of the NSG 4070 for manually changing test frequency and level. This example can be performed direct following examples 7 and 8.



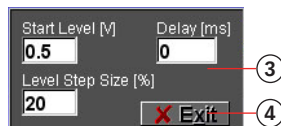
1. Click "MONITOR ON".
2. Click "NSG ON".
3. Click "MODULATION ON".
4. Move the slider to change the "TEST LEVEL".
5. Click inside the diagram to change the current frequency.
6. Click "NSG OFF".
7. Use the "SET" and "STO COM" keys to insert a comment at the actual cursor frequency. Please note: After 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.

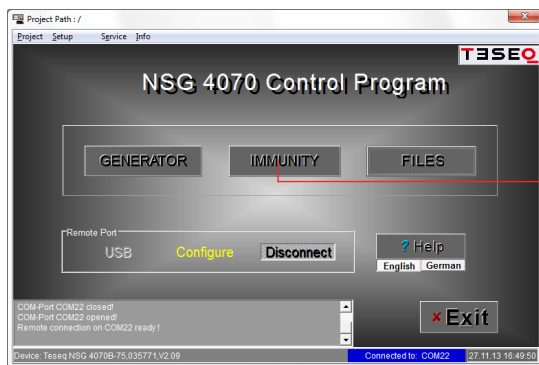
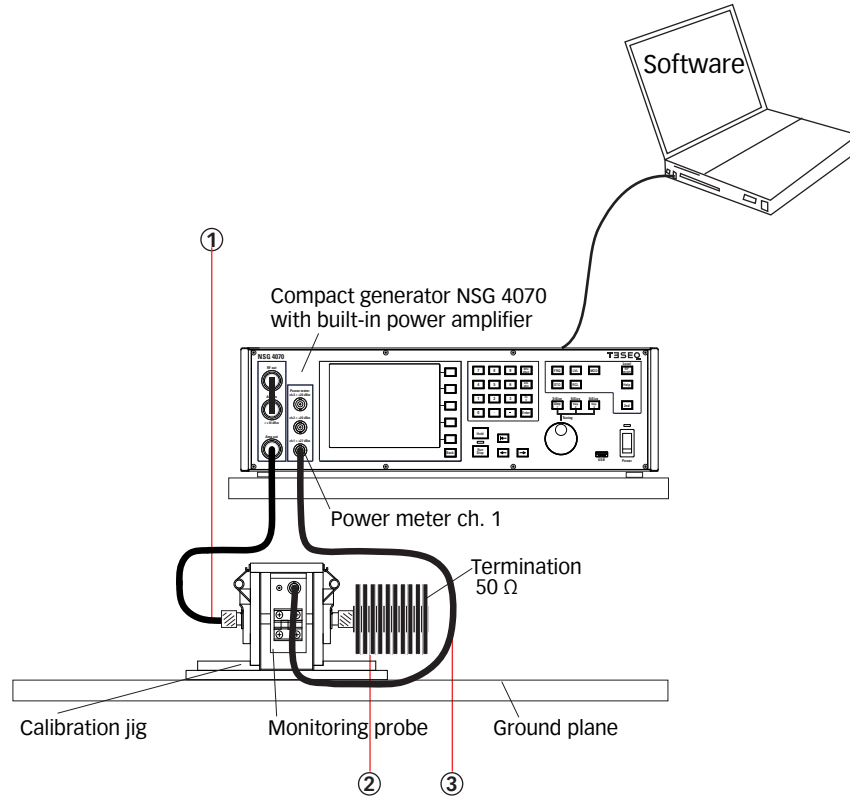


1. Select "THRESHOLD SEARCH UP".
2. Click "SETUP".
3. Change the parameter as required.
4. Click "EXIT".
5. Click "START".

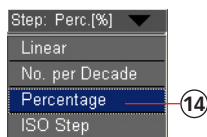
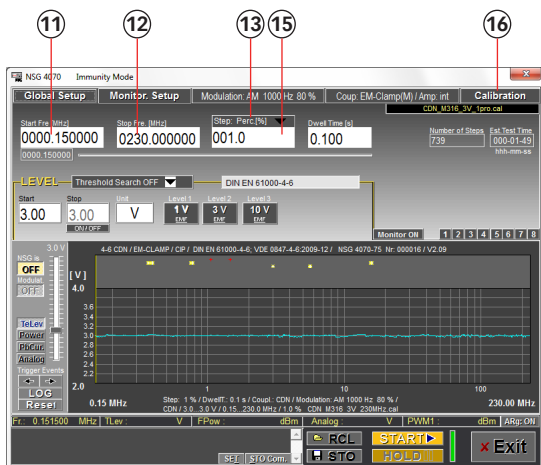
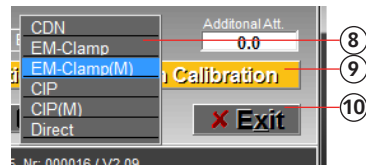
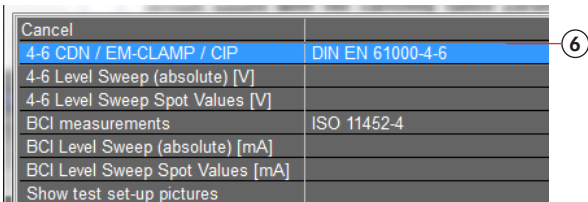
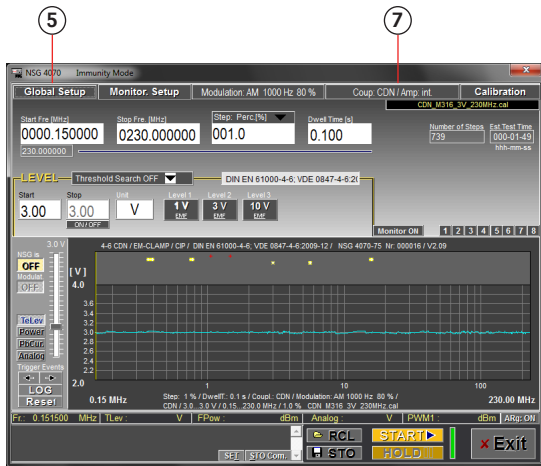


### 11.11. Example 11: NSG 4070 Control Program - Monitoring probe calibration for IEC/EN 61000-4-6

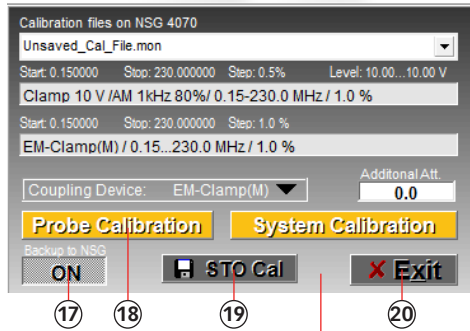
The following example shows the remote operation of the NSG 4070 for calibrating the monitoring probe. This example requires a NSG 4070 with a built-in power amplifier, like the NSG 4070-35, NSG 4070-45 or NSG 4070-80. The probe must be inserted in a 50  $\Omega$  calibration jig. A termination and some RF cables are also required.



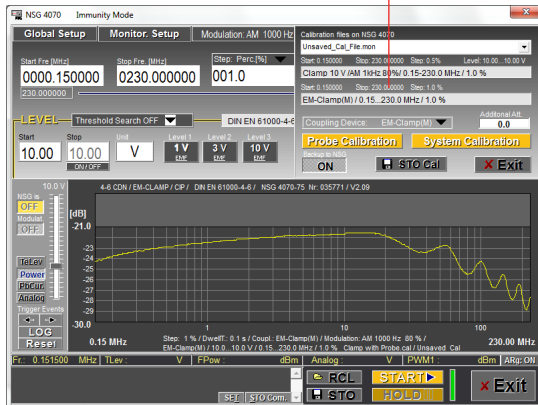
1. Connect "AMP out" to the calibration jig.
2. Terminate one side of the calibration jig with 50  $\Omega$ .
3. Connect the monitoring probe output to the power meter channel 1.
4. Click "IMMUNITY".



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".

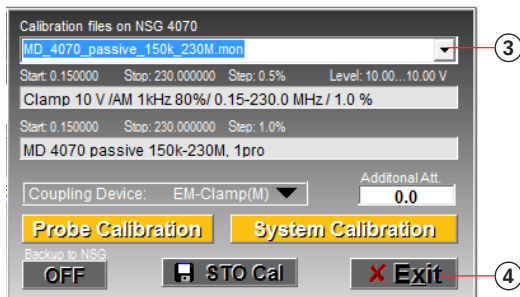
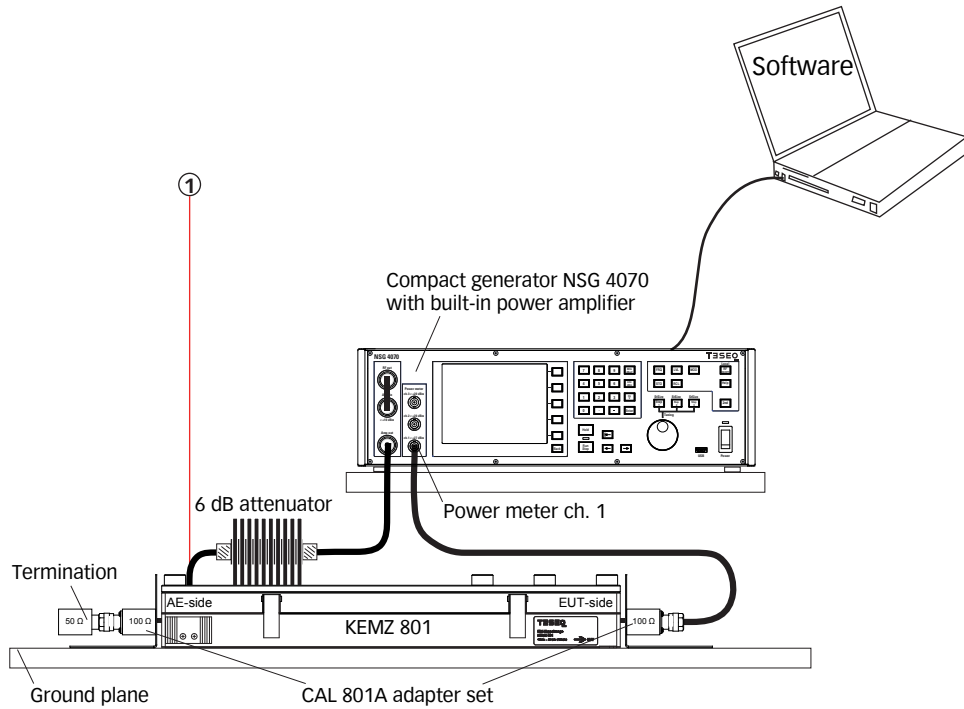


17. Click "BACKUP TO NSG" "ON".
18. Click "PROBE CALIBRATION" and wait.
19. Click "STO CAL" to store the calibration result on the PC and NSG 4070.
20. Click "EXIT".

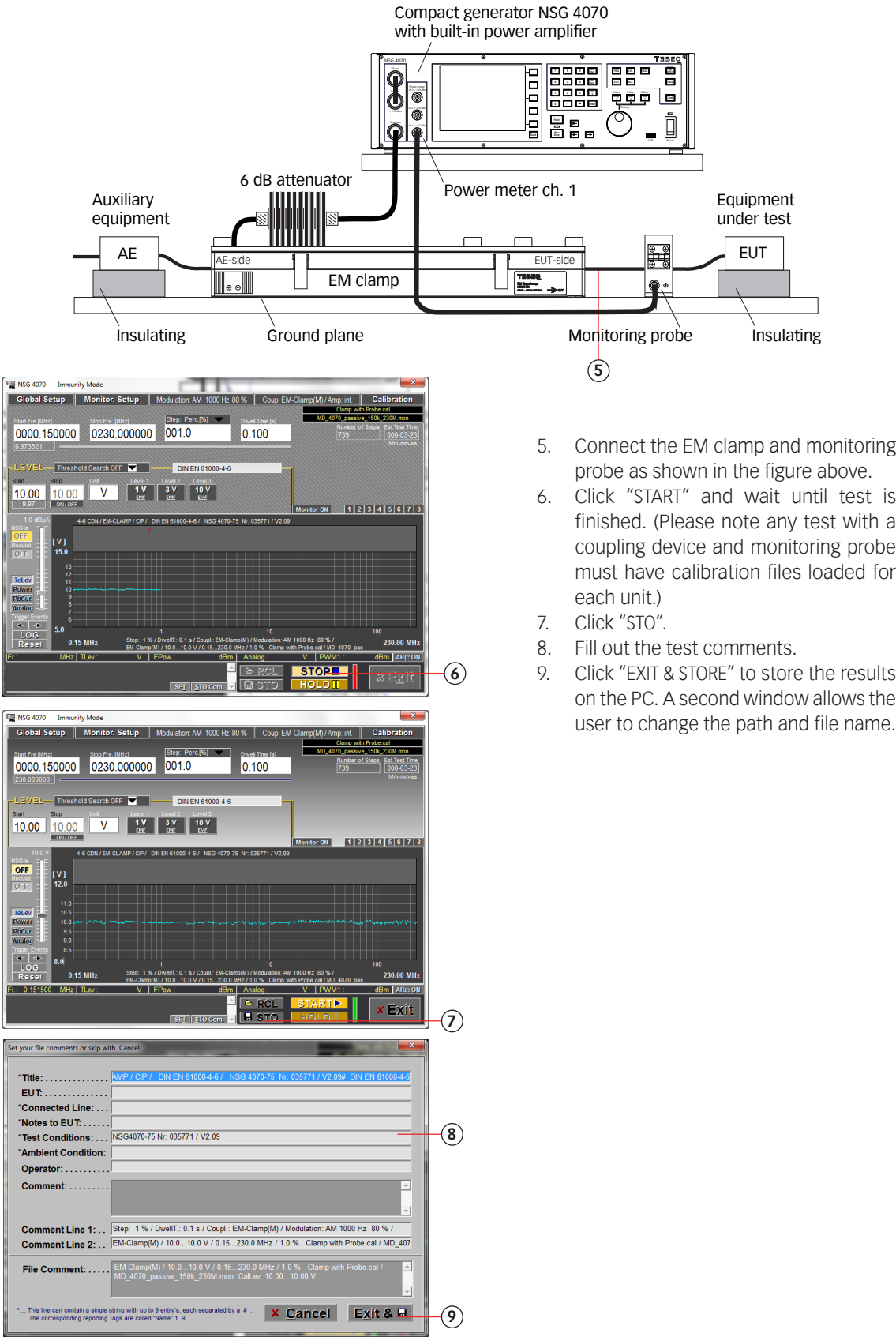


### 11.12. Example 12: NSG 4070 Control Program - IEC /EN 61000-4-6 testing with EM clamp and monitoring probe

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 4070-35, NSG 4070-45 or NSG 4070-80. An EM clamp, monitoring probe, 6 dB attenuator and some RF cables are also required.

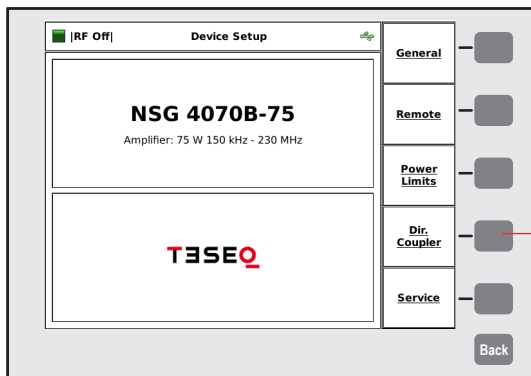
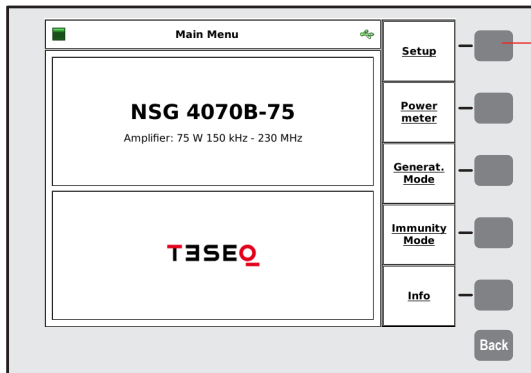
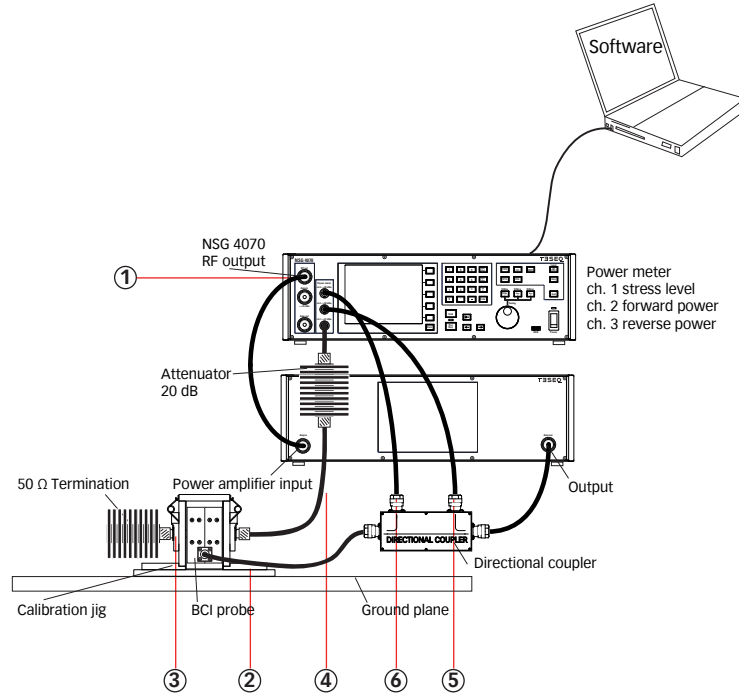


1. Connect the EM clamp as shown in the figure above.
2. Follow example 8 steps #4 to #30 with exception step #13. Select "EM CLAMP (M)"
3. Recall the probe calibration file of example 11
4. Click "EXIT".

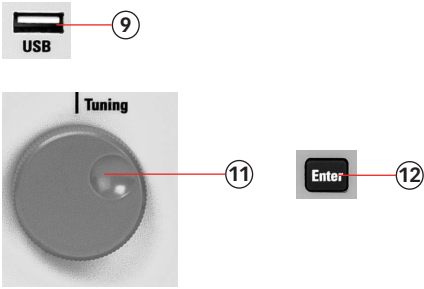
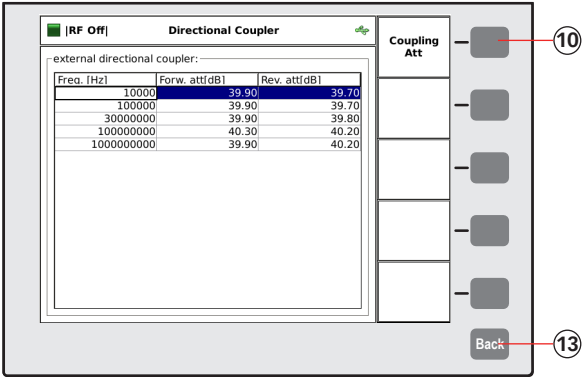


### 11.13. Example 13: NSG 4070 Control Program - BCI testing

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 above.
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 "DIR. COUPLER"

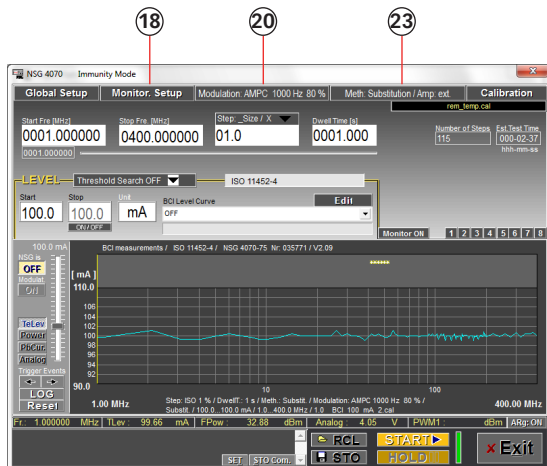


- 9. Insert the USB stick with the correction factors of the directional coupler and wait few seconds.
- 10. Press "COUPLING ATT."
- 11. Turn the knob to select the file.
- 12. Press "ENTER"
- 13. Press "BACK"
- 14. Follow example 7 and establish the remote operation.
- 15. Click "IMMUNITY".
- 16. Click "GLOBAL SETUP".
- 17. Select "BCI MEASUREMENTS".

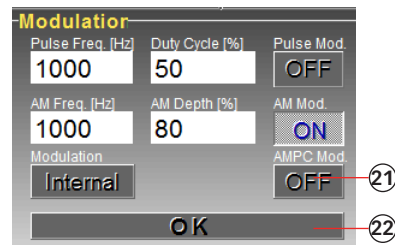
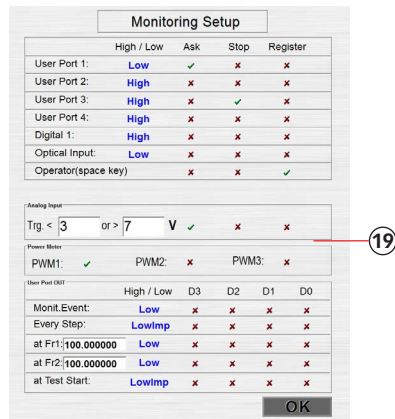


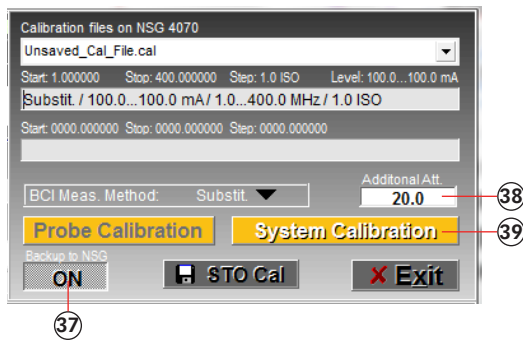
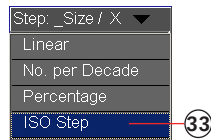
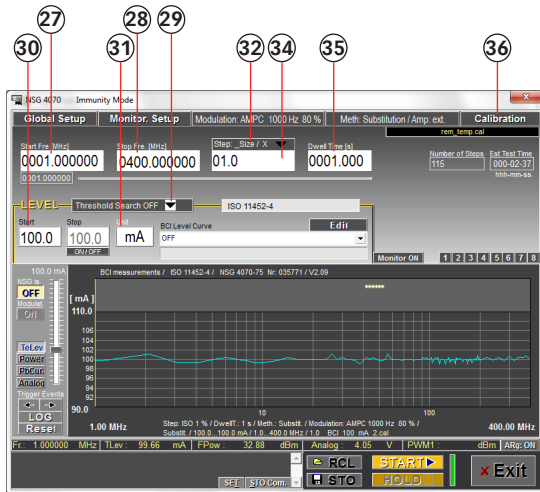
Cancel	
4-6 CDN / EM-CLAMP / CIP	DIN EN 61000-4-6
4-6 Level Sweep (absolute) [V]	
4-6 Level Sweep Spot Values [V]	
BCI measurements	ISO 11452-4
BCI Level Sweep (absolute) [mA]	
BCI Level Sweep Spot Values [mA]	
Show test set-up pictures	



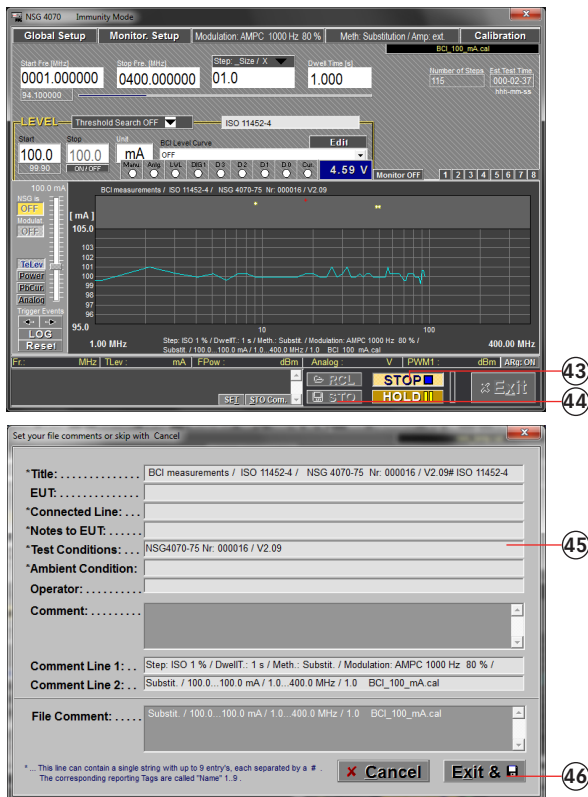
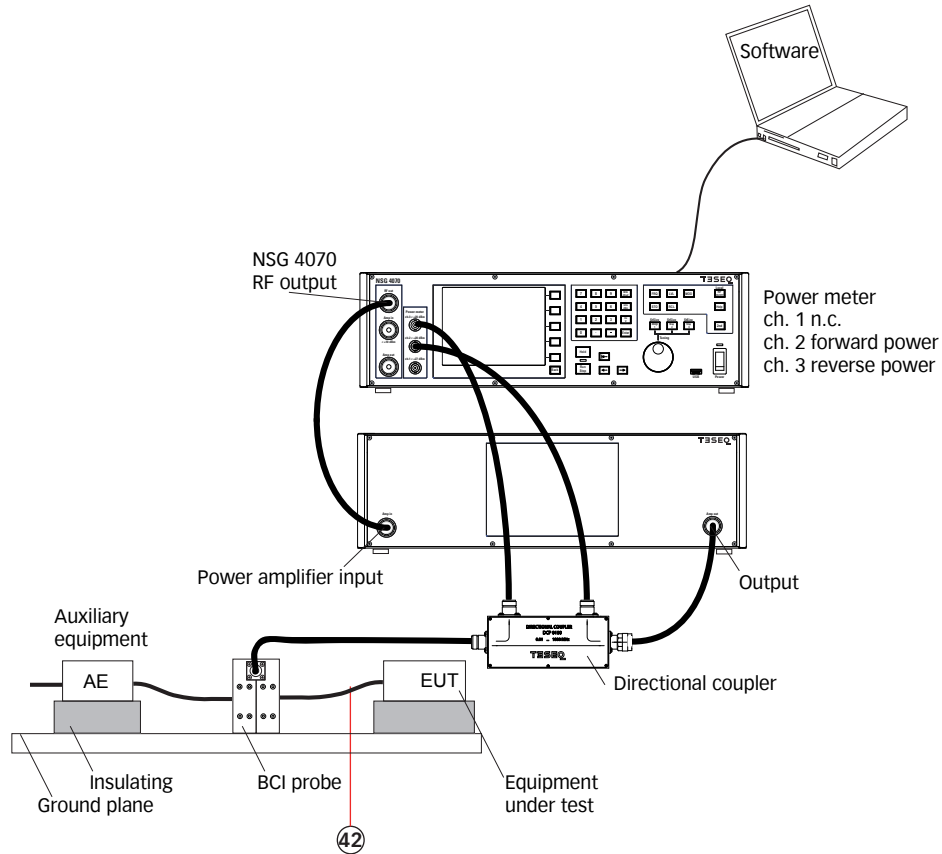


18. Click "MONITOR. SETUP".
19. Switch off all EUT monitoring ports for this example. Click to select "x".
20. Click "MODULATION ...".
21. Change to 1000 Hz, 80% and AM PC.
22. Click "OK".
23. Click "METH: SUB. ...".
24. Select "SUBSTITUT".
25. Select amplifier "EXTERNAL".
26. Click "OK".





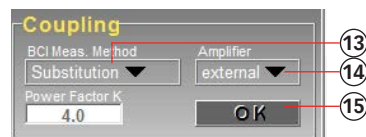
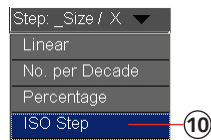
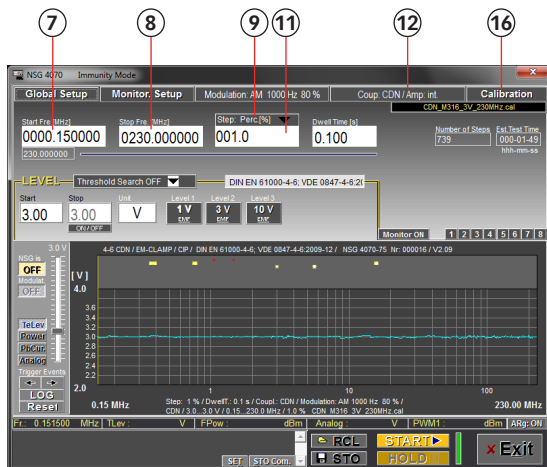
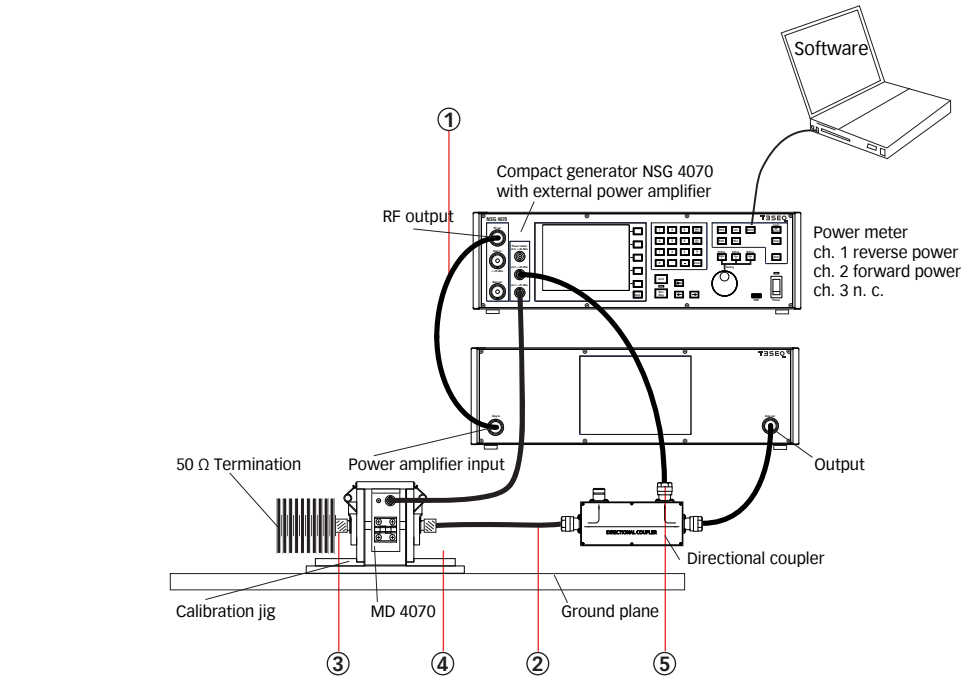
27. Change the "START FREQ." to "1".
28. Change the "STOP FREQ." to "400".
29. Select "THRESHOLD SEARCH OFF".
30. Change to "100".
31. Double click to change the unit to "mA".
32. Click "STEP:..."
33. Select "ISO STEP".
34. Change the "STEP SIZE" to "1.0".
35. Change the "DWELL TIME" to "1.0".
36. Click "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".



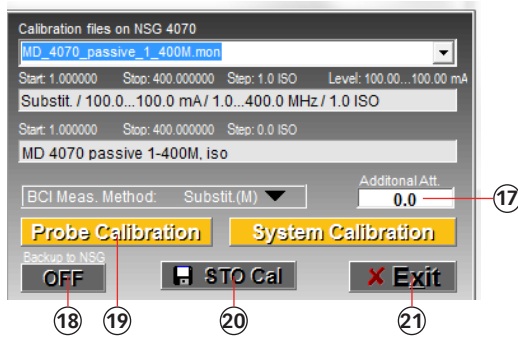
42. Remove the calibration adapters and connect the EUT.
43. Click "START" and wait until test is finished.
44. Click "STOP".
45. Fill out the test comments.
46. Click "EXIT & STORE" to store the results on the PC. A second window allows the user to change the path and file name.

### 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.



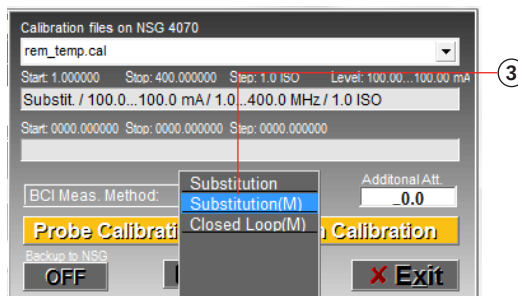
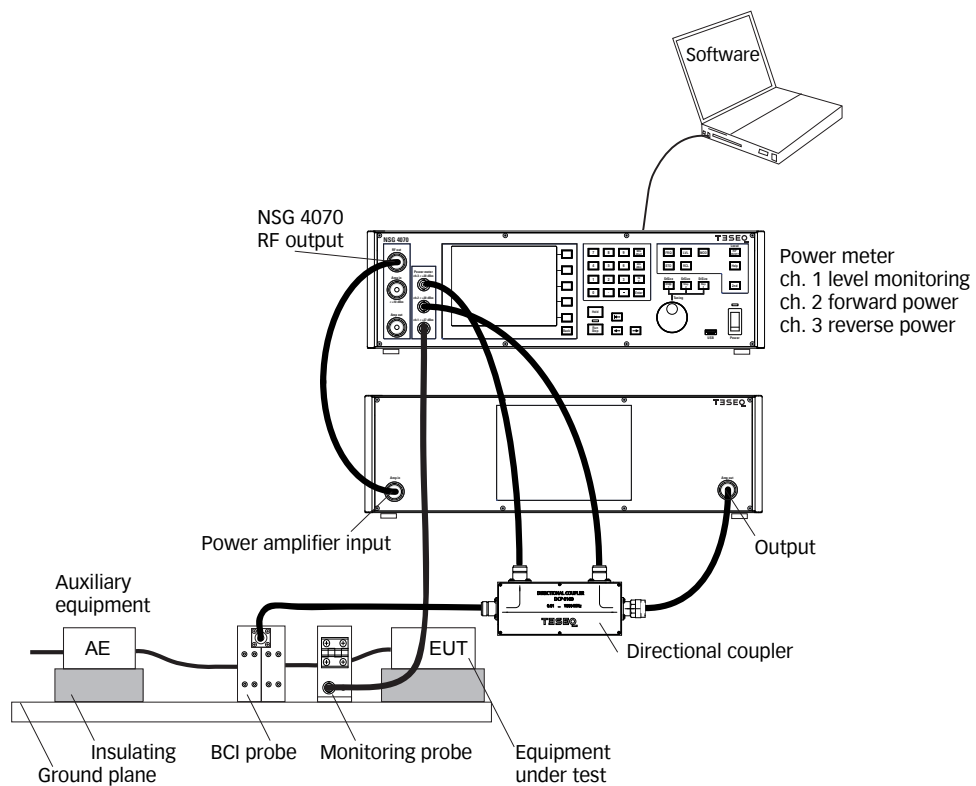
1. Connect "RF out" to the power amplifier input.
2. Connect the output of the power amplifier via the directional coupler to the calibration jig.
3. Terminate the calibration jig as shown in the figure above.
4. Connect the RF output of the probe to the power meter channel 1.
5. Connect the directional 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".



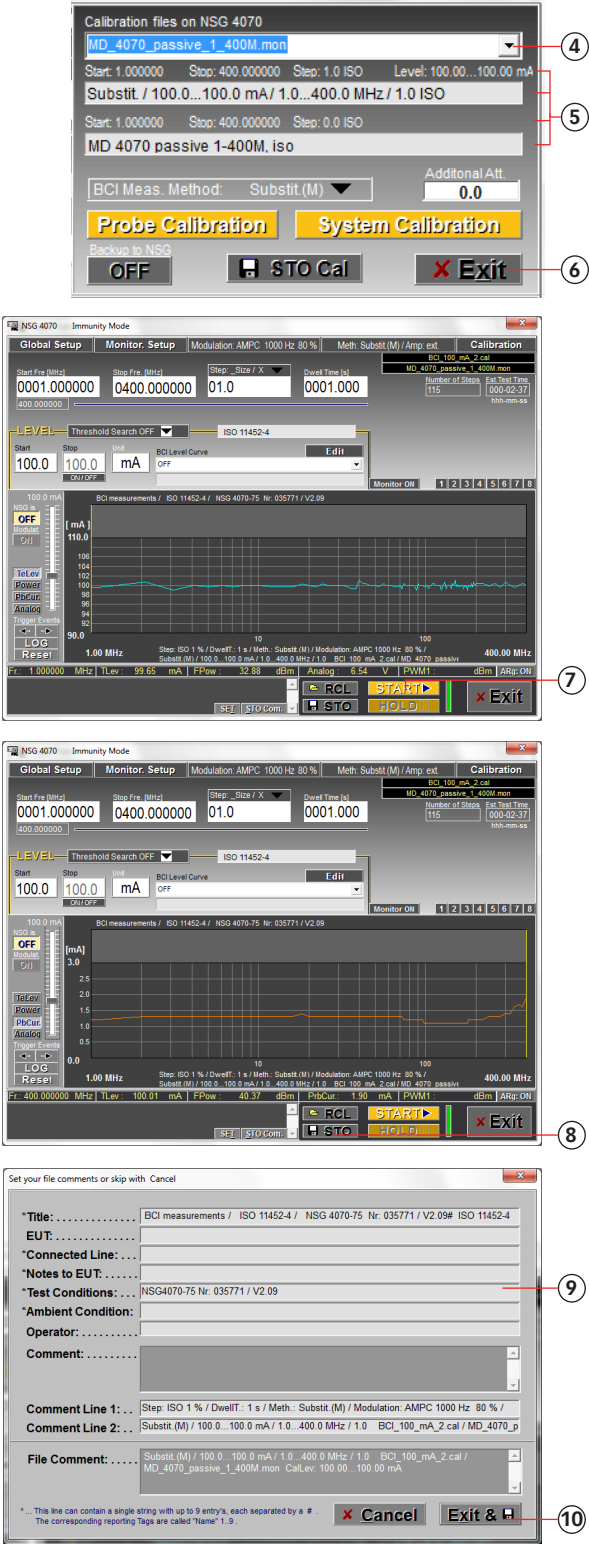
17. Change the value of the additional attenuator to 0. (No attenuator is required to protect power meter 1 for probe calibration).
18. Click "BACKUP TO NSG" "ON".
19. Click "PROBE CALIBRATION" and wait.
20. Click "STO CAL" to store the calibration result on the PC and NSG 4070.
21. Click "EXIT".

### 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.



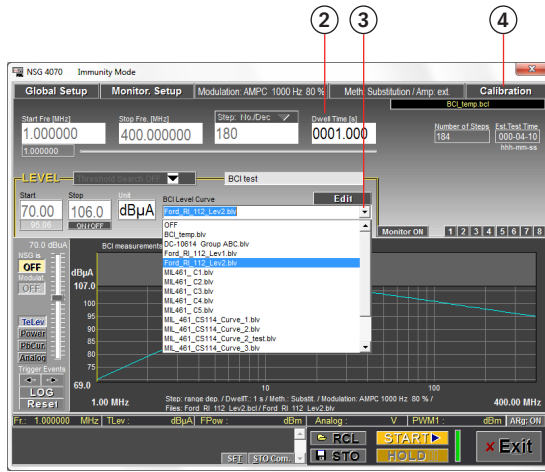
1. Connect the BCI probe and monitoring probe as shown in the figure above.
2. Follow example 13 steps #1 to #40. The system calibration file should be loaded.
3. Select "SUBSTITUTION (M)" or "CLOSED LOOP (M)"



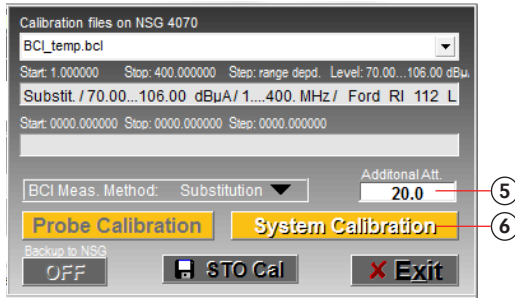
- Recall the probe calibration file of example 14.
- The comments and parameters of the selected files will be displayed.
- Click "EXIT"
- Click "START" and wait until test is finished. (Please note any test with BCI and monitoring probe must have a calibration file loaded for each unit)
- Click "STO".
- Fill out the test comments.
- 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.

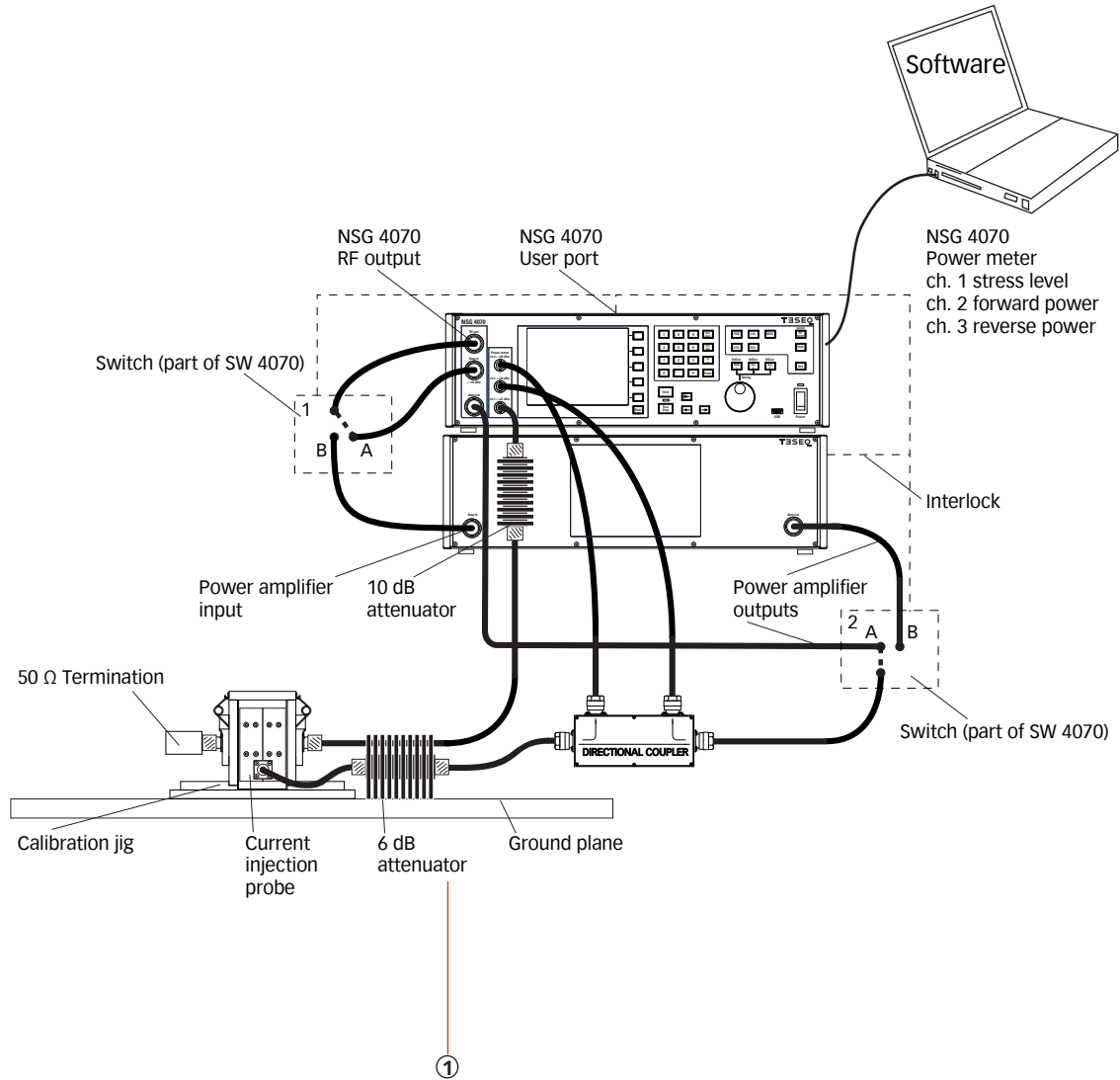


1. Follow example 13 steps #1 to #26.
2. Change the "DWEELL TIME" to "1.0".
3. Select a "BCI LEVEL CURVE".
4. Press "CALIBRATION".
5. Press "ADDITIONAL ATT." and type in 20 in the case a 20 dB attenuator is used to protect power meter 1 (recommended for tests with  $\geq 100$  mA or  $\geq 100$   $\mu$ A).
6. Follow example 13 steps #39 to #46.



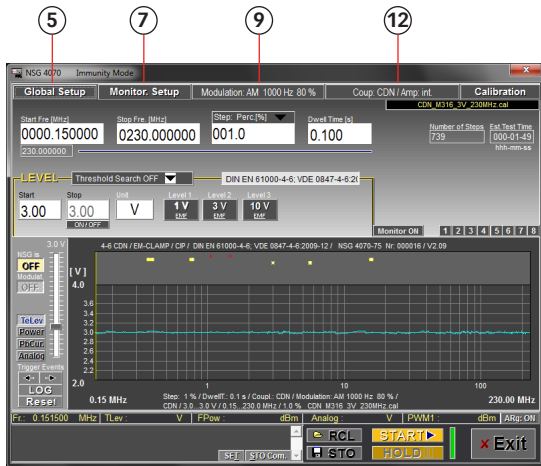
### 11.17. Example 17: NSG 4070 Control Program - extended IEC/EN 61000-4-6 testing

The following example shows the remote operation of the NSG 4070 for extended testing based on IEC/EN 61000-4-6. This example requires a NSG 4070 with a built-in power amplifier, external power amplifier, external directional coupler, RF switch SW 4070 and current injection probe with calibration jig and termination. Attenuators and some RF cables are also required. The test level is set in a 50  $\Omega$  system.

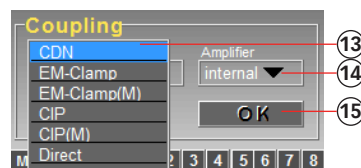
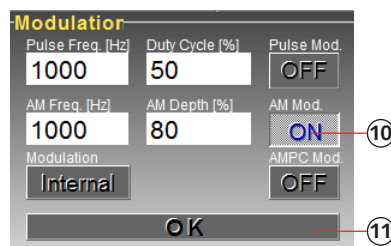
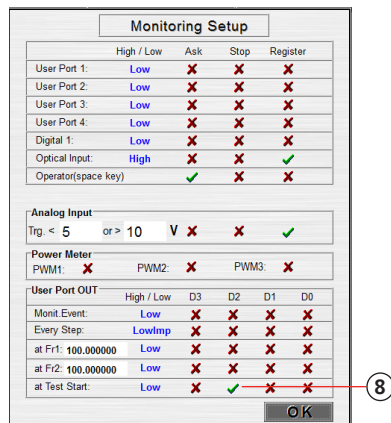
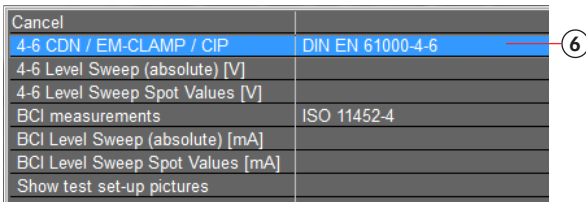


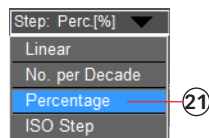
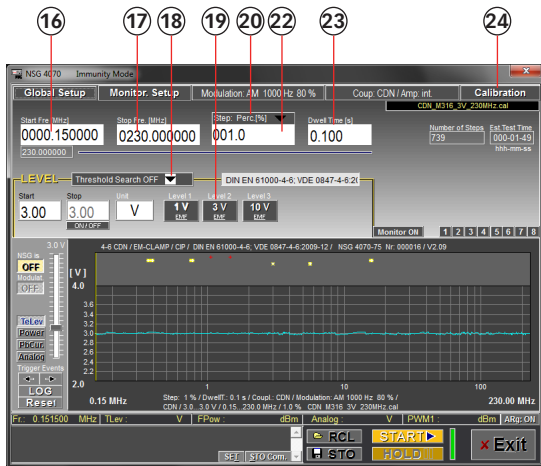
1. Connect the equipment as shown in the figure above.
2. Follow example 4 steps #9 to #21 for copying the directional coupler factors to the NSG 4070 and setting the system limits.
3. Follow example 7 for initiating the remote connection.
4. Click "IMMUNITY".



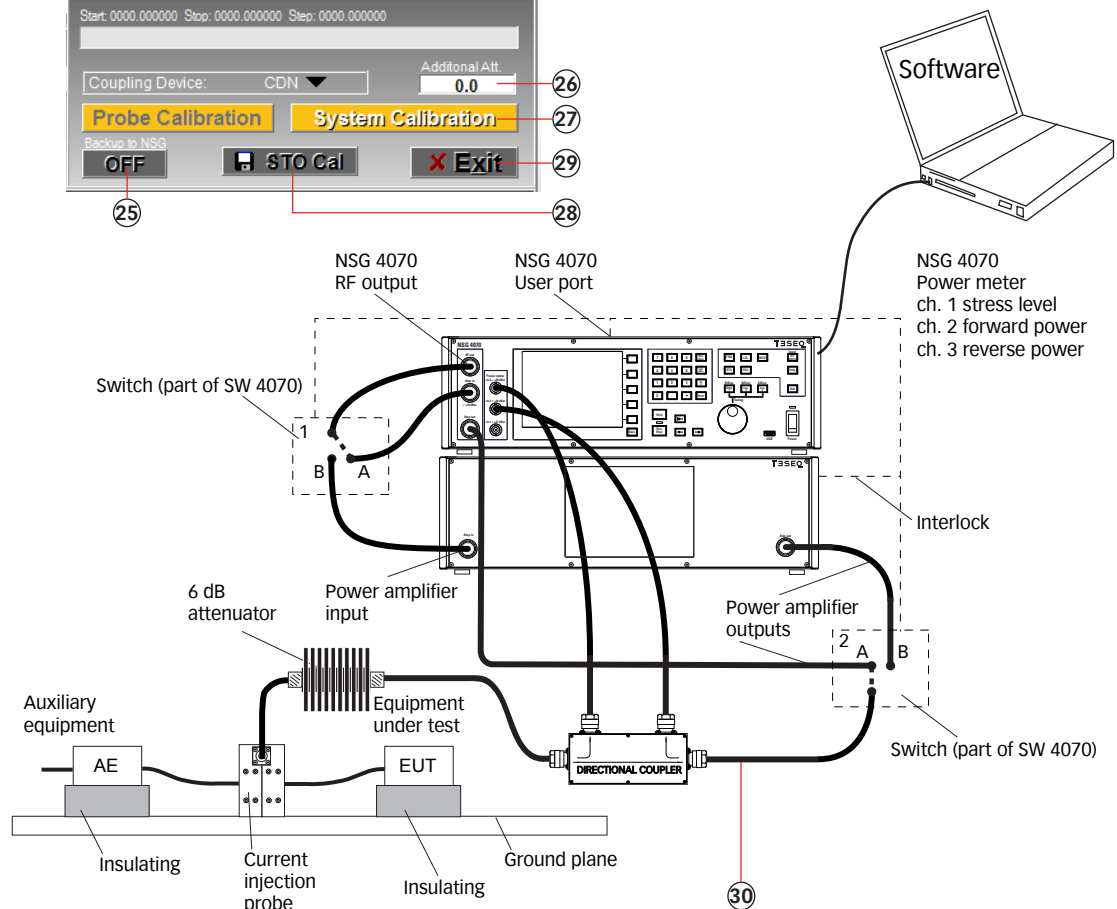
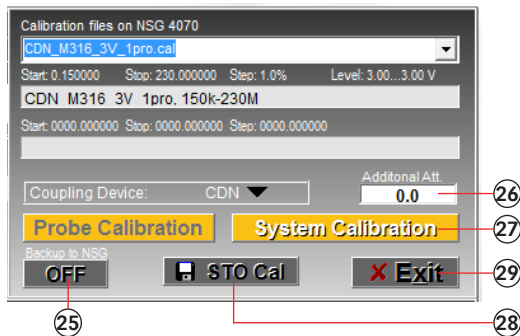


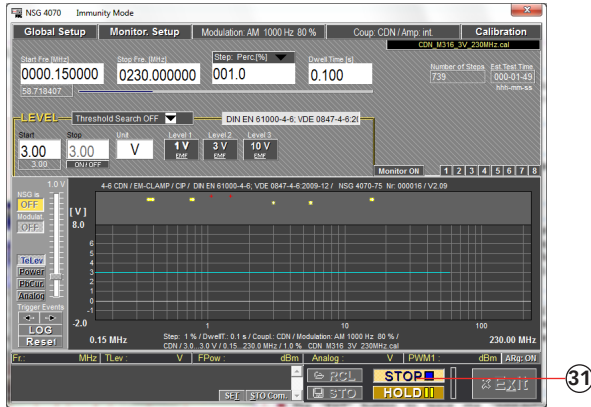
5. Click "GLOBAL SETUP".
6. Select "4-6 CDN / EM CLAMP / CIP".
7. Click "MONITOR. SETUP".
8. Change item "at TEST START" to "High" and select "✓" for user port output D2. This configuration switches the SW 4070 to path "B" during calibration and test. Change to "Low" for using path "A".
9. Click "MODULATION ...".
10. Change to 1000 Hz, 80% and AM.
11. Click "OK".
12. Click "COUP: CDN ...".
13. Select "CIP".
14. Select amplifier "MIXED".
15. Click "OK".



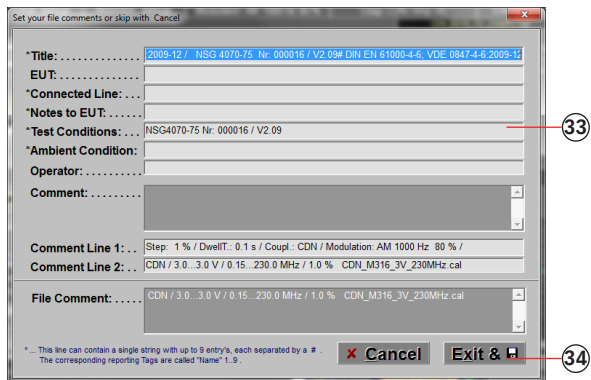
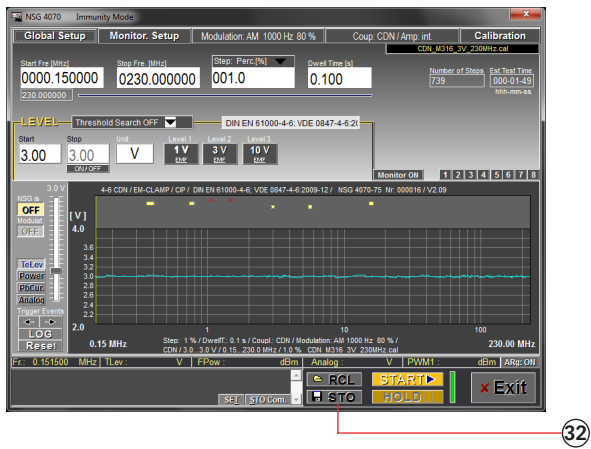


16. Change the "START FREQ."
17. Change the "STOP FREQ."
18. Select "THRESHOLD SEARCH OFF".
19. Change the test level.
20. Click "STEP:.....".
21. Select "PERCENTAGE".
22. Change the "STEP SIZE" to "1.0".
23. Change the "DWELL TIME" to "1.0".
24. Click "CALIBRATION".
25. Click "BACKUP TO NSG" "ON".
26. Change "ADDITIONAL ATT." to "-9.5". Change "ADDITIONAL ATT." to "0.5" if using test level of 10 V EMF and having power meter channel 1 protected with 10 dB attenuator.
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 finished.
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.



## **12. MAINTENANCE**

### **12.1. General**

The NSG 4070 including the accessories need no special maintenance. The maintenance is limited to the cleaning of the contacts. The life time of the connectors is limited because of the contact durability. Teseq can replace the worn out connectors.

No modifications are to be carried out on the NSG 4070 and accessories by the user.

### **12.2. Cleaning**

The cleaning shall be done with dry cloth. If a wet cleaning would become necessary, make sure that no humidity will enter inside of the unit and clean the instrument housing with a damp cloth using a little mild, non-abrasive household cleanser if necessary.

Chemicals must not be used for cleaning purposes

## **13. DISPOSAL**

The unit is constructed that it can be dismantled right down to the component level.

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