



# **SOFTWARE FOR EMC IMMUNITY TESTING ICD.CONTROL**

**APPLICATION NOTE  
ISO 11452-4**

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This application note requires icd.control version 6 or newer.

## CONTENT

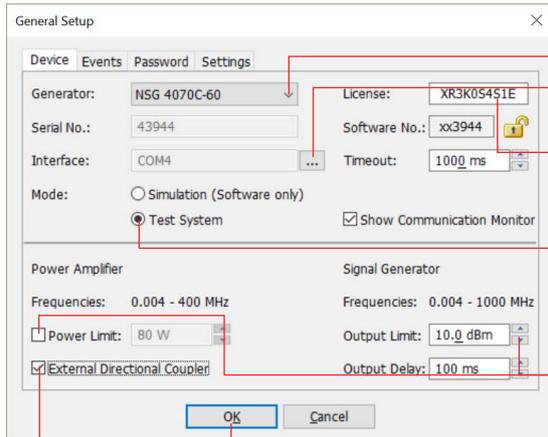
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# 1. EXAMPLE ISO 11452-4 TEST WITH EXTERNAL DIRECTIONAL COUPLER AND AMPLIFIER

## 1.1. Basic Settings

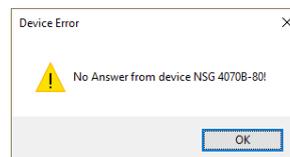


- Clicking on "General Setup" opens the generator settings menu.



- Select the appropriate generator model.
- If necessary, configure the interface.
- Enter the license number from the license certificate. The associated serial number is displayed in the left field.
- Select "Test system" for operation with connected generator. Choose simulation to control the settings, to get to know the program especially if there is no hardware.
- If necessary, set limits for the connected hardware. "Power Limit" limits the forward power. This avoids that in case of error, e.g. Power meter for the measurement of the target level not connected, the generator fully controlled and thus the power amplifier gives full power and thus the connected hardware is damaged. „Output Limit" limits the output level of the signal generator and is e.g. to 0 dBm if the maximum input power of the connected amplifier is limited to 0 dBm.

- When leaving the menu with "OK", the \*idn? Command is sent to the device. If the answer is correct, the program changes to the main menu. If there is no connection, an error message appears. example:



- By clicking on "OK" the program changes again into the settings.

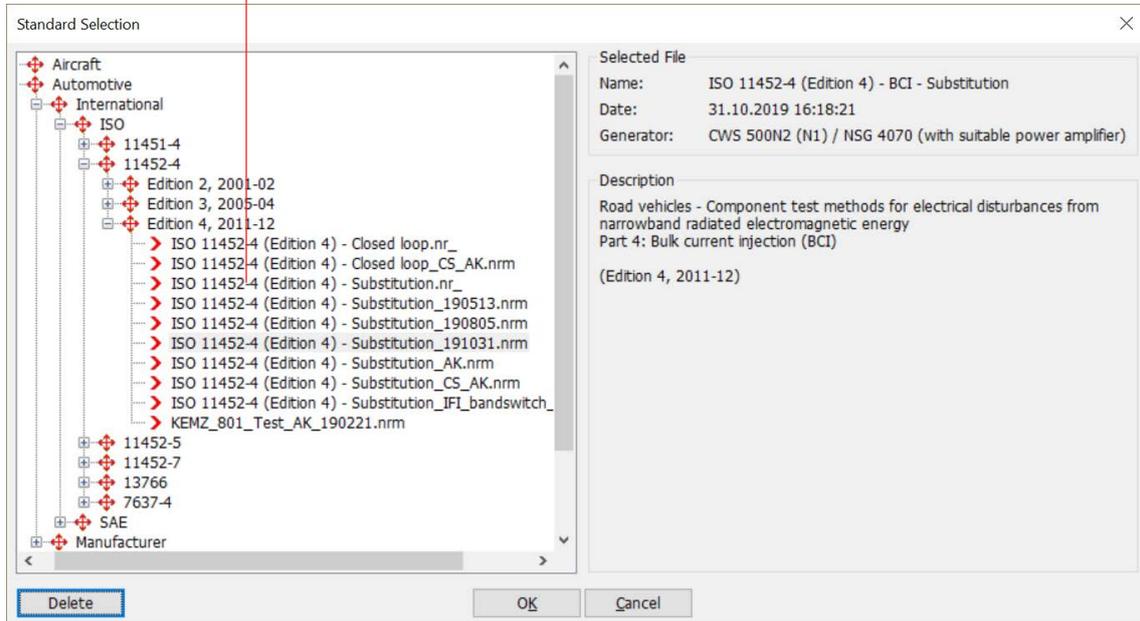
- If the hacking is set, the NSG 4070 expects the forward power at channel 2. For operation with the internal power amplifier and internal directional coupler, the hook must not be set.

## 1.2. Selecting and loading the test configuration



Click here to open the library.

Click here to open the configuration.



### 1.3. Calibration (test level adjustment) for the substitution method

■ Select "Calibration" to set the test level setting for the connected hardware.

■ Select here the appropriate coupling network.

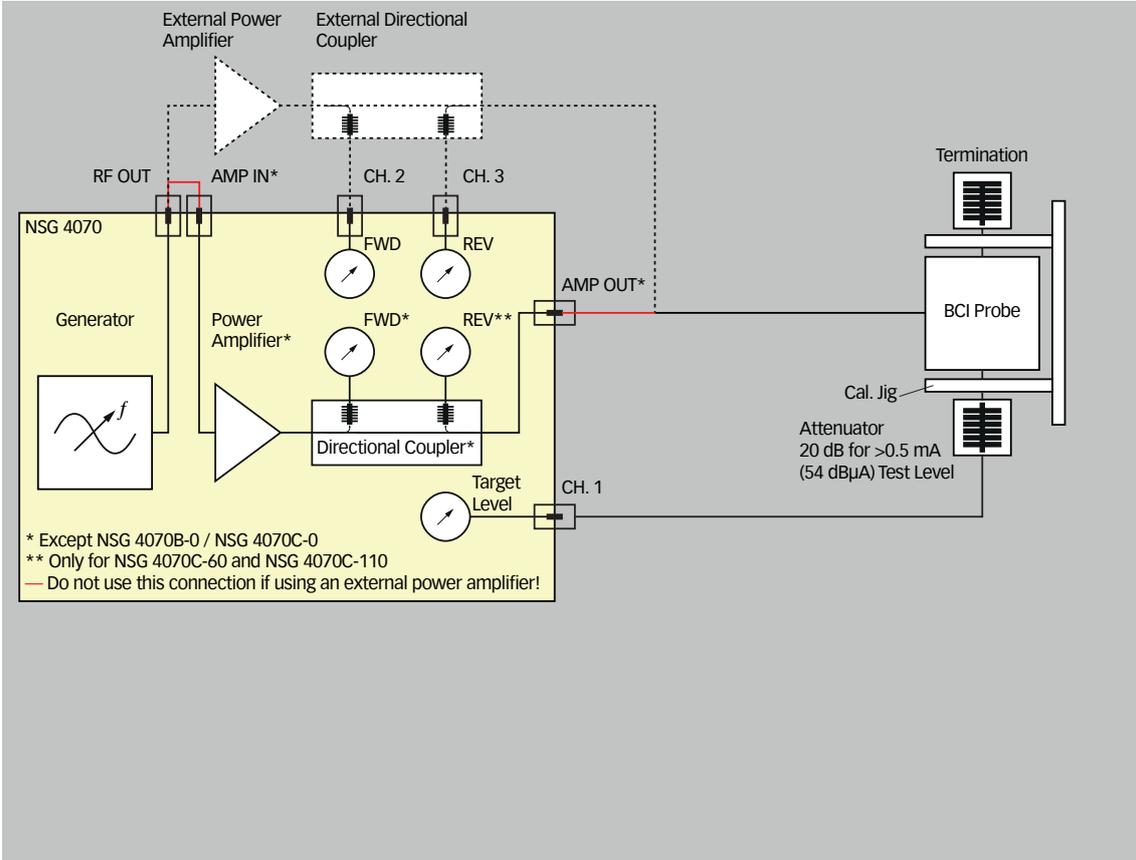
■ Select "Setup Standard" to change the basic settings for this test. See the example below.

■ Choose "Calibration".

■ With a value of, for example, -6 dB, the level would be lowered by 6 dB at each frequency step and then gradually increased to the target level. A level reduction may be required by the standard. During calibration (procedure for setting the test level) these requirements do not usually exist and a value of 0 dB shortens the calibration time.

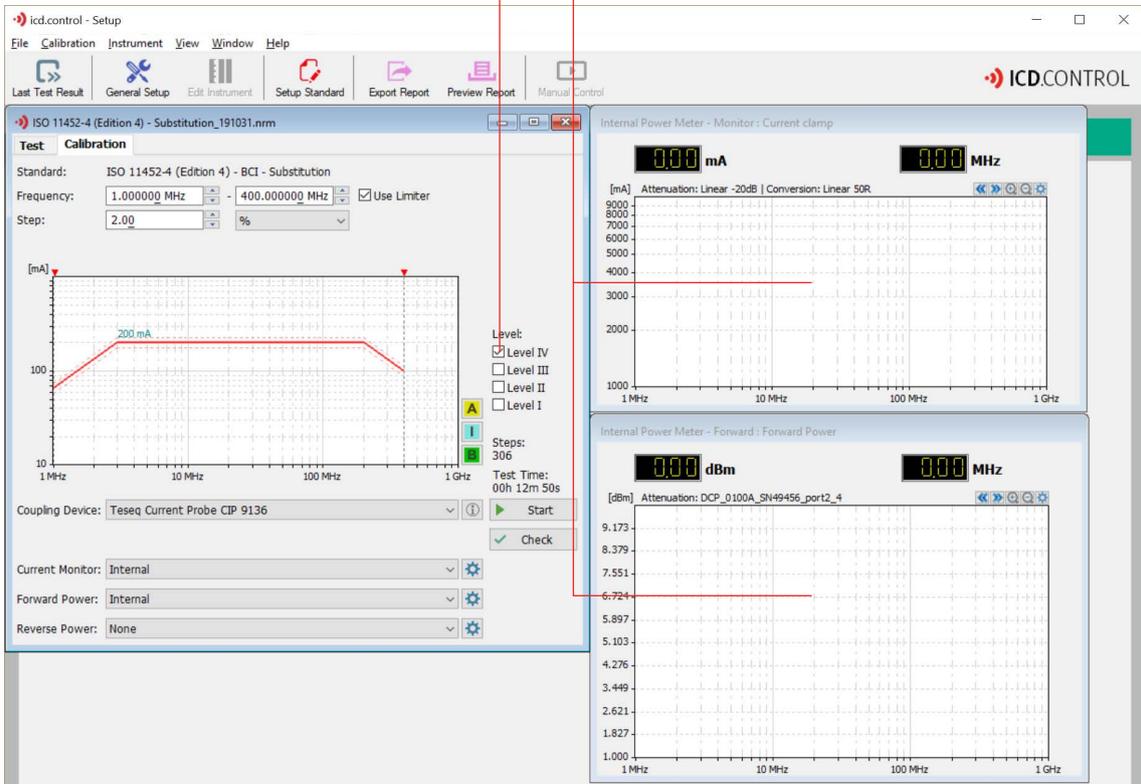
■ Click "OK" to save the settings.

■ Select "View" and "Show Test Setup" to display a sample image for the test setup.



■ Set the test level.

■ A double-click into the diagram or a simple click on the settings symbol  opens the following menus.



The screenshot shows the ICD.CONTROL software interface. The main window is titled "ISO 11452-4 (Edition 4) - Substitution\_191031.nrm". It features a menu bar (File, Calibration, Instrument, View, Window, Help) and a toolbar with icons for Last Test Result, General Setup, Edit Instrument, Setup Standard, Export Report, Preview Report, and Manual Control. The main area is divided into several sections:

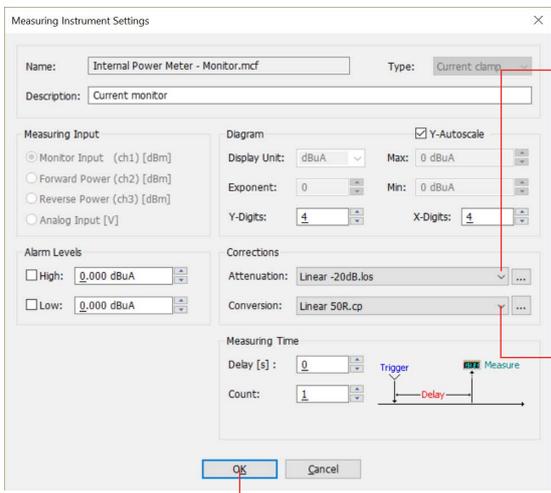
- Test Calibration:** Shows standard information (ISO 11452-4 (Edition 4) - BCI - Substitution), frequency settings (1.000000 MHz, 400.000000 MHz), and step settings (2.00 %).
- Graphs:** A graph shows a test level of 200 mA. To its right, a "Level" section has radio buttons for Level IV (selected), Level III, Level II, and Level I. Below it, "Steps: 306" and "Test Time: 00h 12m 50s" are displayed.
- Internal Power Meter - Monitor: Current clamp:** Shows a reading of 0.00 mA and 0.00 MHz. The graph below it shows a flat line at 0 mA across a frequency range from 1 MHz to 1 GHz.
- Internal Power Meter - Forward: Forward Power:** Shows a reading of 0.00 dBm and 0.00 MHz. The graph below it shows a flat line at 0 dBm across the same frequency range.

Red arrows point from the text instructions to the "Level" section and the gear icons for the "Current Monitor", "Forward Power", and "Reverse Power" settings.

■ Here, select the file containing the correction data of the attenuator connected on the power meter channel 1 of the NSG 4070, e.g. -20 dB for a 20 dB attenuator. This file can be supplemented with the attenuation values of the connected cable, recommended for long lines. For attenuation values, the software expects a minus sign before the numerical value. Clicking on the icon  opens the file.

■ Select here the file which allows the correction data for current measurement in the 50 ohm jig, e.g. Linear 50R.cp. Clicking on the icon  opens the file.

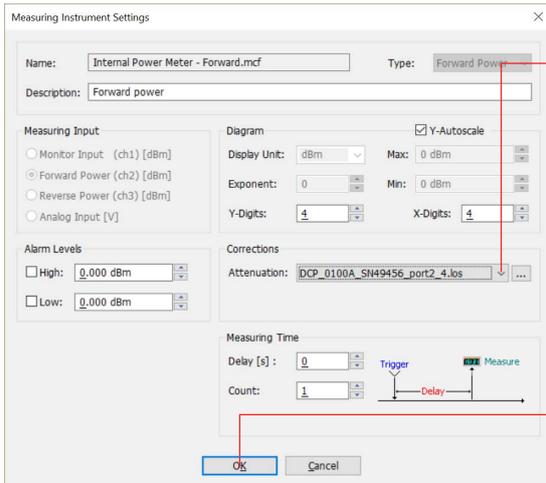
■ Click "OK" to save the settings.



The screenshot shows the "Measuring Instrument Settings" dialog box. It has a title bar and a close button (X). The settings are as follows:

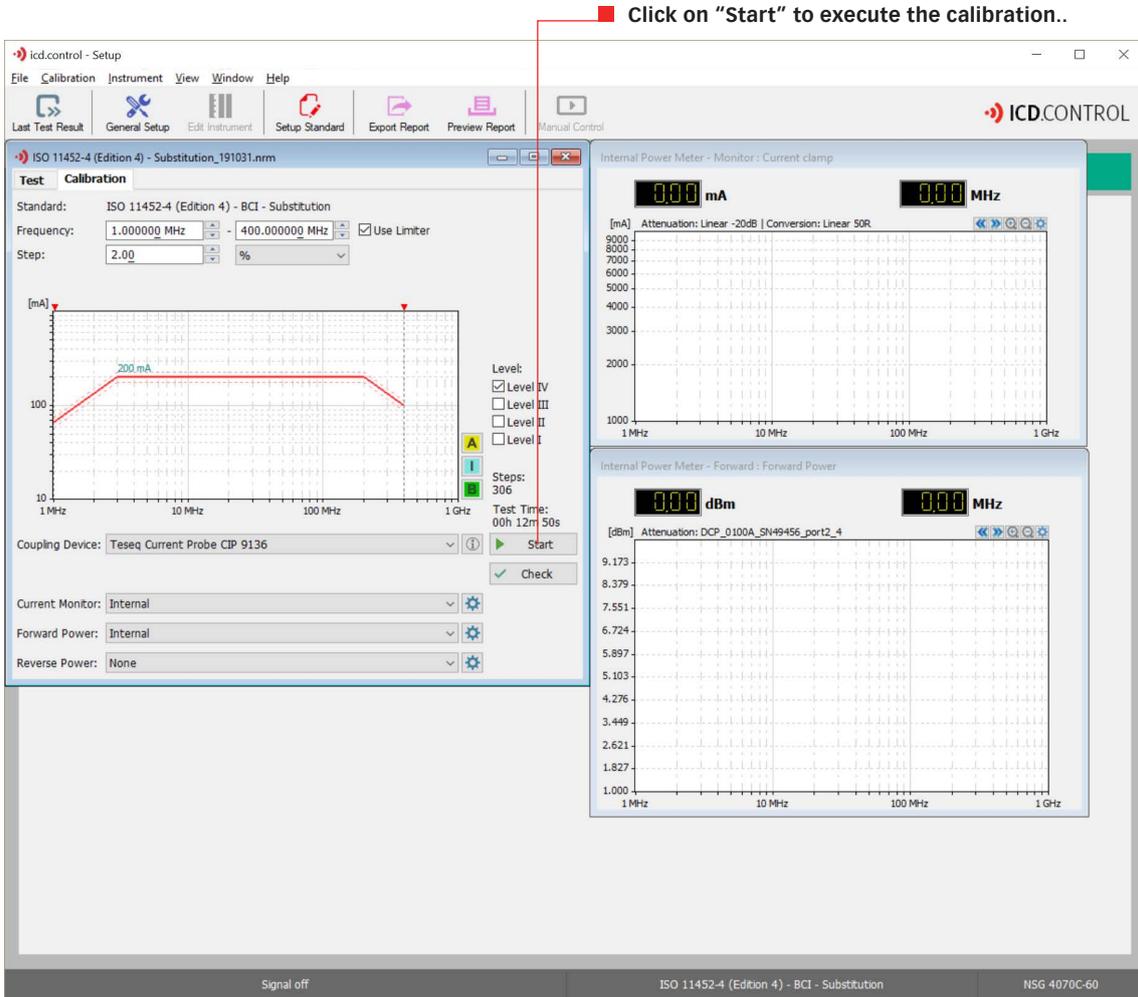
- Name:** Internal Power Meter - Monitor.mcf
- Type:** Current clamp
- Description:** Current monitor
- Measuring Input:** Monitor Input (ch1) [dBm] (selected), Forward Power (ch2) [dBm], Reverse Power (ch3) [dBm], Analog Input [V]
- Diagram:** Y-Autoscale (checked), Display Unit: dBuA, Max: 0 dBuA, Exponent: 0, Min: 0 dBuA, Y-Digits: 4, X-Digits: 4
- Corrections:** Attenuation: Linear -20dB.los (selected), Conversion: Linear 50R.cp (selected)
- Measuring Time:** Delay [s]: 0, Count: 1

Red arrows point from the text instructions to the file selection icons in the "Corrections" and "Measuring Time" sections, and to the "OK" button.



■ Select here the file which contains the correction data for the path used for measuring the forward power of the external directional coupler. Clicking on the icon  opens the file.

■ Click "OK" to save the settings.

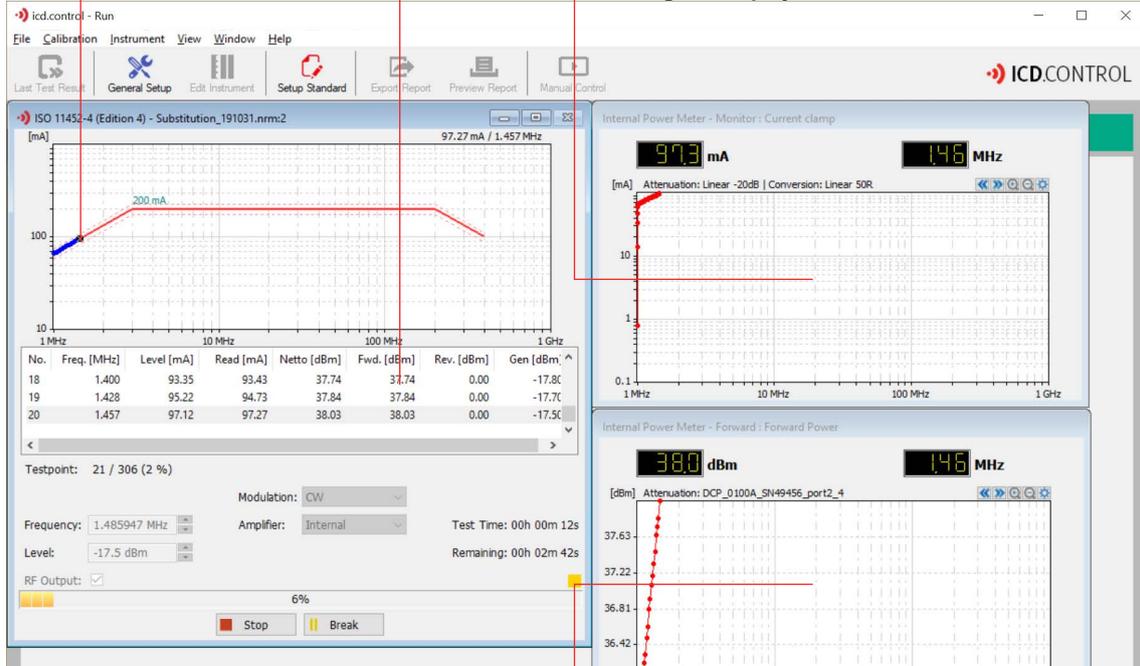


■ Click on "Start" to execute the calibration..

■ In the diagram, the achieved levels are displayed as blue dots and the target values as a red line.

■ Below the diagram, a table displays the values of frequency, target level, set level, net, forward, reverse (not used here) and generator power.

■ The Internal Power Meter - Monitor: Current Clamp Diagram displays the set levels.



■ The Internal Power Meter - Forward Power Diagram shows the required forward power for each level.

The Calibration Report dialog box shows the following information:

- Range: Frequency: 1 - 400 MHz, 2 %; Level: 200 mA
- Environment: Temperature: 23.0°C; Humidity: 46 %; Pressure: 988 mbar
- Coupling Device: Name: Teseq Current Probe CIP; Range: 0.01 - 400 MHz; SNo: [blank]; Note: [blank]; Description: [blank]

Buttons: Save, Cancel

■ After successful calibration, the operator is prompted to save the file.

■ A comment can be inserted.

■ Click "Save" to save the settings.

The Save calibration dialog box shows a list of existing calibration files and a text field for the file name. The file name is: Teseq Current Probe CIP 9136, Level 5, 0\_01 - 200 MHz\_191031

Buttons: Save, Cancel

■ A file name must be assigned.

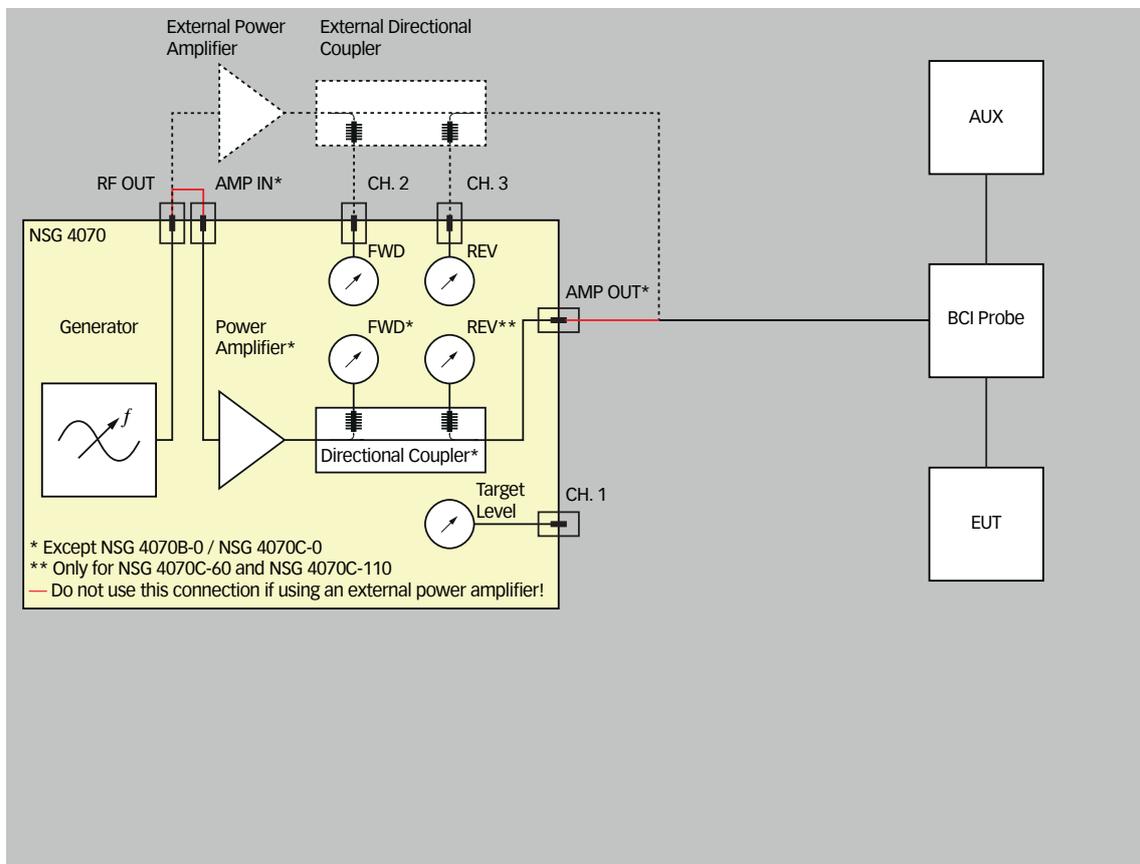
■ Click "Save" to save the calibration.

## 1.4. Test with substitution method

- Immediately after calibration and saving the results, the program enters the test mode.
- Select "View" and "Show Test Setup" to display a sample image for the test setup.



The screenshot shows the ICD.CONTROL software interface. The 'Test' tab is active, displaying 'ISO 11452-4 (Edition 4) - Substitution\_191031.nrm'. The 'View' menu is open, showing options like 'Last Test Result', 'General Setup', 'Edit Instrument', 'Setup Standard', 'Export Report', 'Preview Report', and 'Manual Control'. A secondary window titled 'Internal Power Meter - Forward : Forward Power' shows '0.00 dBm' and '0.00 MHz'.



The screenshot displays the ICD.CONTROL software interface. The main window is titled "ISO 11452-4 (Edition 4) - Substitution\_191031.nrm" and is in the "Setup Standard" tab. The "Calibration" section shows the following settings:

- Standard: ISO 11452-4 (Edition 4) - BCI - Substitution
- Frequency: 1.000000 MHz - 400.000000 MHz (with "Use Limiter" checked)
- Step: 2.00 %
- Dwell Time: 2.0 s

A graph shows a current profile of 200 mA over a frequency range from 1 MHz to 1 GHz. The "Level" section has "Level IV" checked. The "Steps" are 306, and the "Test Time" is 00h 12m 50s. The "Coupling Device" is "Teseq Current Probe CIP 9136". The "Calibration File" is "Teseq Current Probe CIP 9136, 200 mA, 1 - 400 MHz, 2 %\_191". The "Current Monitor" is "None". The "Forward Power" is "Internal". The "Reverse Power" is "None".

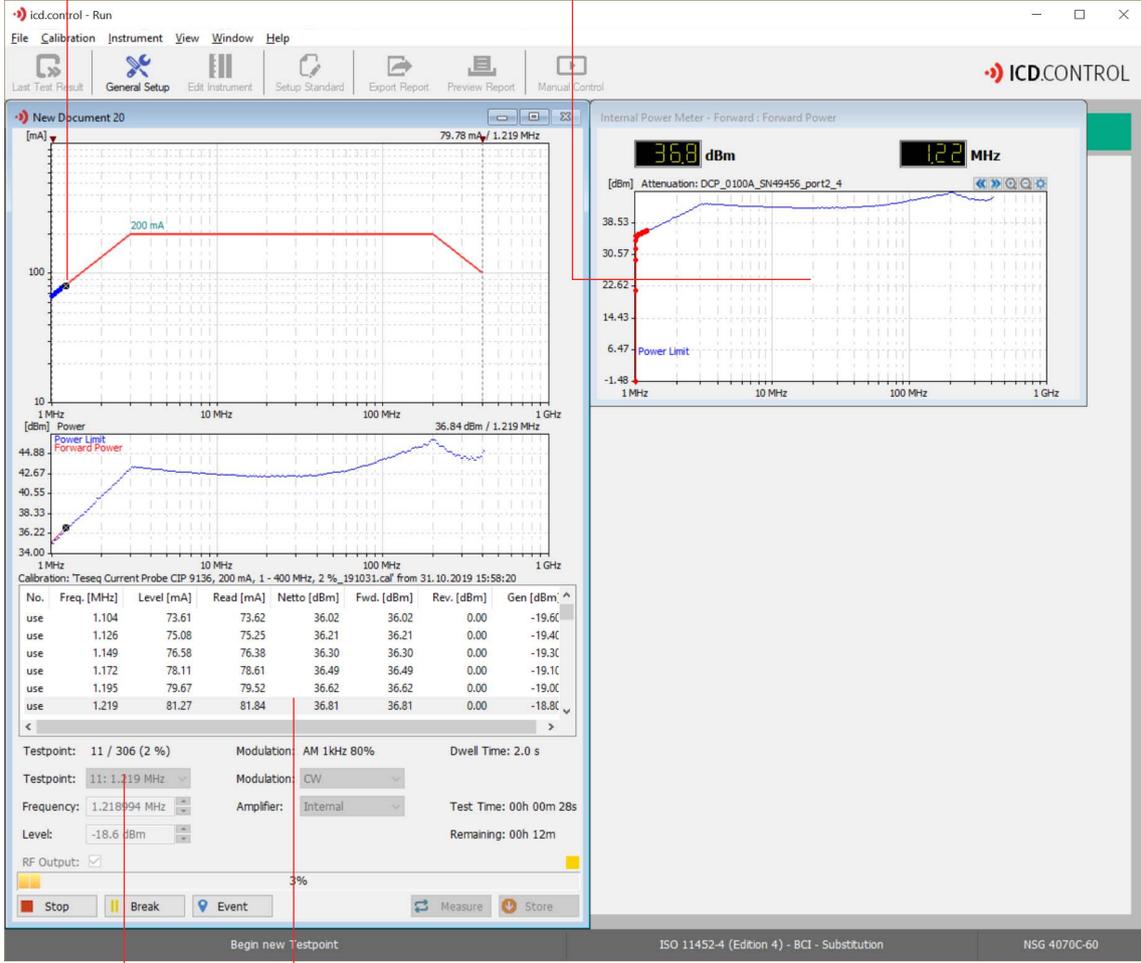
The "Internal Power Meter" window shows "Forward Power" with a reading of 0.00 dBm and 0.00 MHz. The graph shows a power level of 0 dBm across the frequency range from 1 MHz to 1 GHz. The "Attenuation" is "DCP\_0100A\_SN49456\_port2\_4".

Red arrows point from the following instructions to the corresponding UI elements:

- Change the dwell time according to the standard specification. (Points to the "Dwell Time" field)
- Change in "Setup standard" eg. the lowering of the level per frequency step according to the standard specification. Click on the edge of the window if the "Setup Standard" switch is greyed out. (Points to the "Setup Standard" tab)
- Click on Start to run the test. (Points to the "Start" button)
- Immediately after calibration and saving the results, this file is used for the test. If necessary, select another calibration file. Click on the icon  to display the content (Points to the "Calibration File" field)

■ In the diagram, the achieved levels are displayed as blue dots and the target values as a red line.

■ The Internal Power Meter - Forward Power Diagram displays the set forward power for each frequency step.

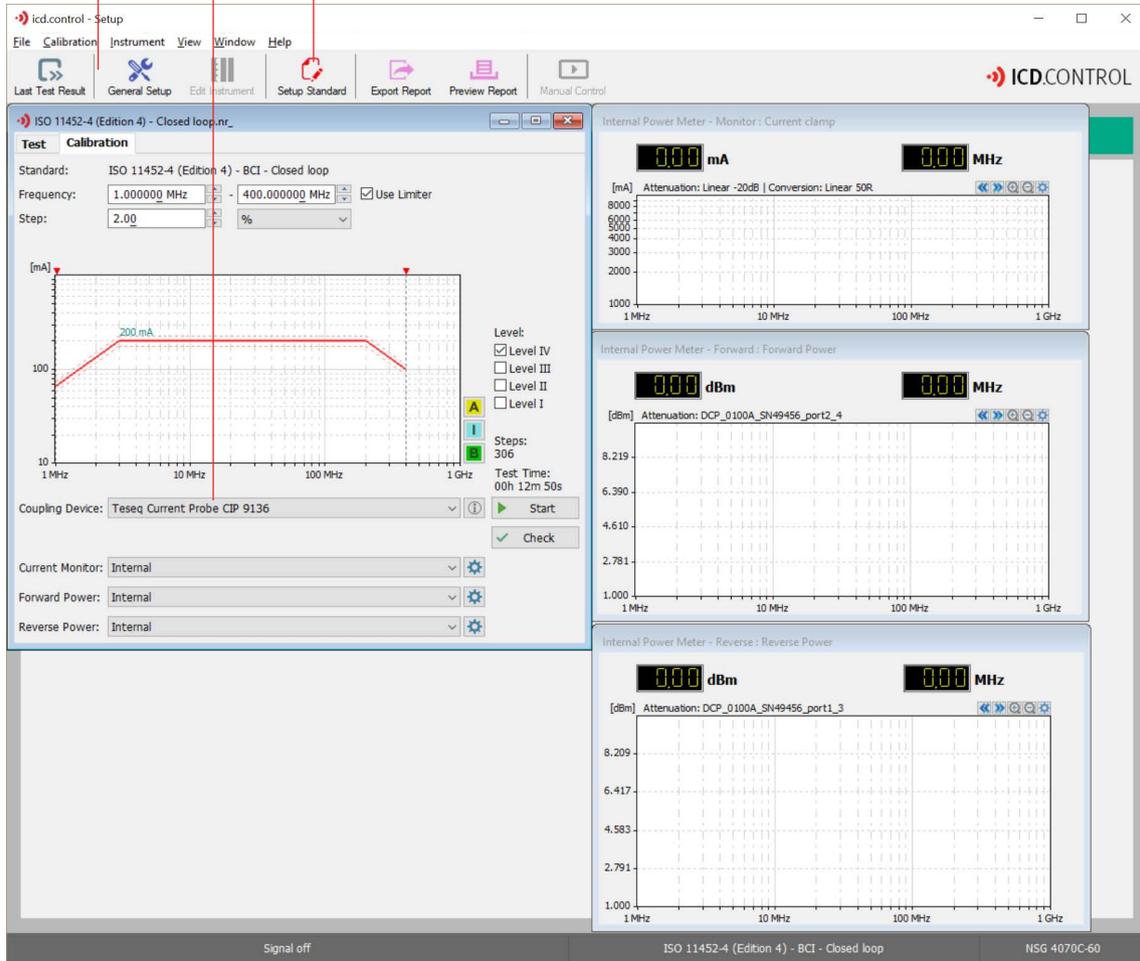


■ The table shows the currently used values of the calibration file.

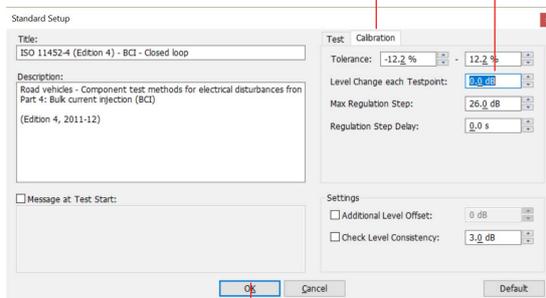
■ The status area displays the test time, remaining test time, dwell time, and the status of the modulation and level. The button Break can be used to switch directly to the manual mode, for example, to check at a specific frequency with lowered level.

### 1.5. Calibration (test level adjustment) for closed-loop method

- Select "Calibration" to set the test level setting for the connected hardware.
- Select here the appropriate coupling network.
- Select "Setup Standard" to change the basic settings for this test. See the example below.

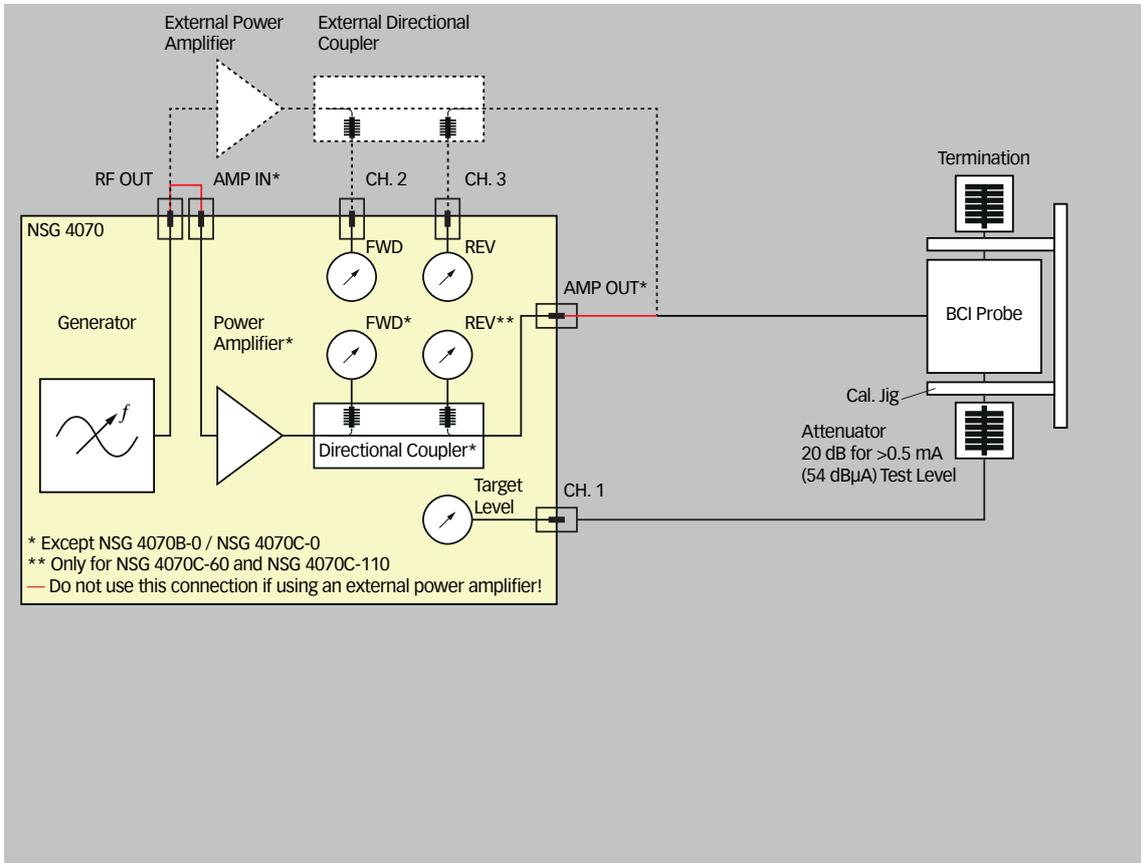


- Choose "Calibration".
- With a value of, for example, -6 dB, the level would be lowered by 6 dB at each frequency step and then gradually increased to the target level. A level reduction may be required by the standard. During calibration (procedure for setting the test level) these requirements do not usually exist and a value of 0 dB shortens the calibration time.

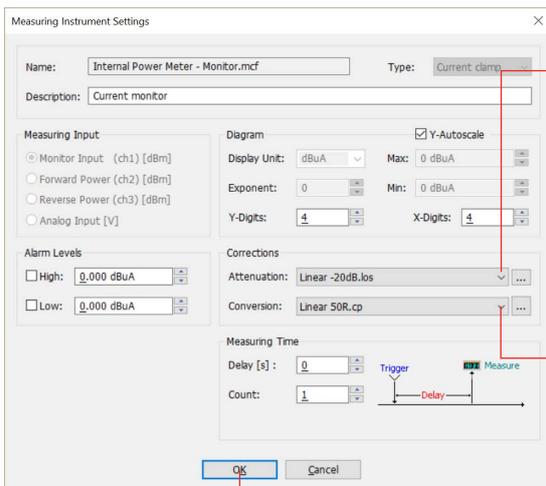
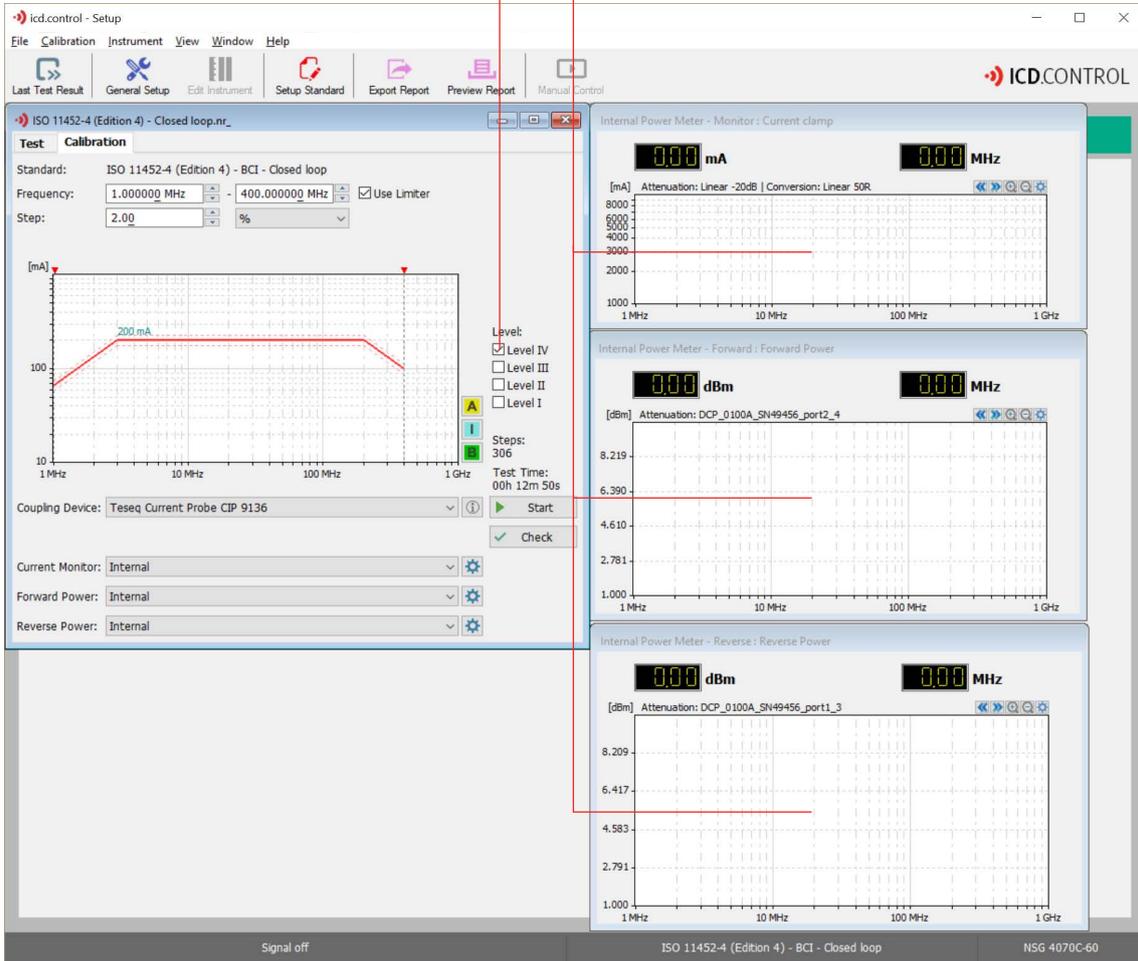


- Click "OK" to save the settings.

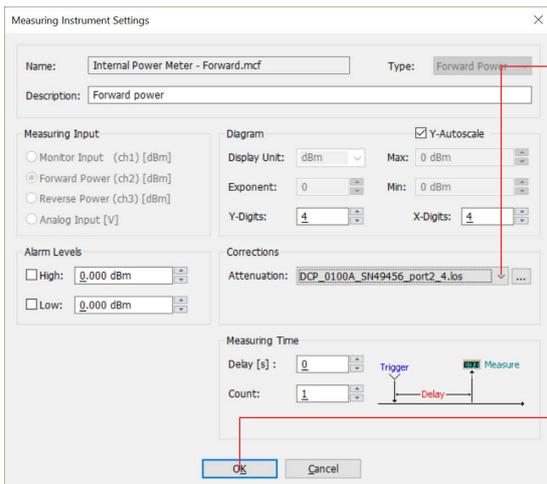
■ Select "View" and "Show Test Setup" to display a sample image for the test setup.



- Set the test level.
- A double-click into the diagram or a simple click on the settings symbol  opens the following menus.

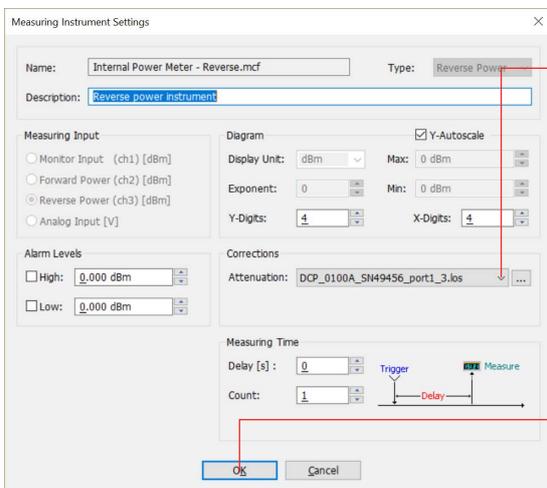


- Here, select the file containing the correction data of the attenuator connected on the power meter channel 1 of the NSG 4070, e.g. -20 dB for a 20 dB attenuator. This file can be supplemented with the attenuation values of the connected cable, recommended for long lines. For attenuation values, the software expects a minus sign before the numerical value. Clicking on the icon  opens the file.
- Select here the file which allows the correction data for current measurement in the 50 ohm jig, e.g. Linear 50R.cp. Clicking on the icon  opens the file.
- Click "OK" to save the settings.



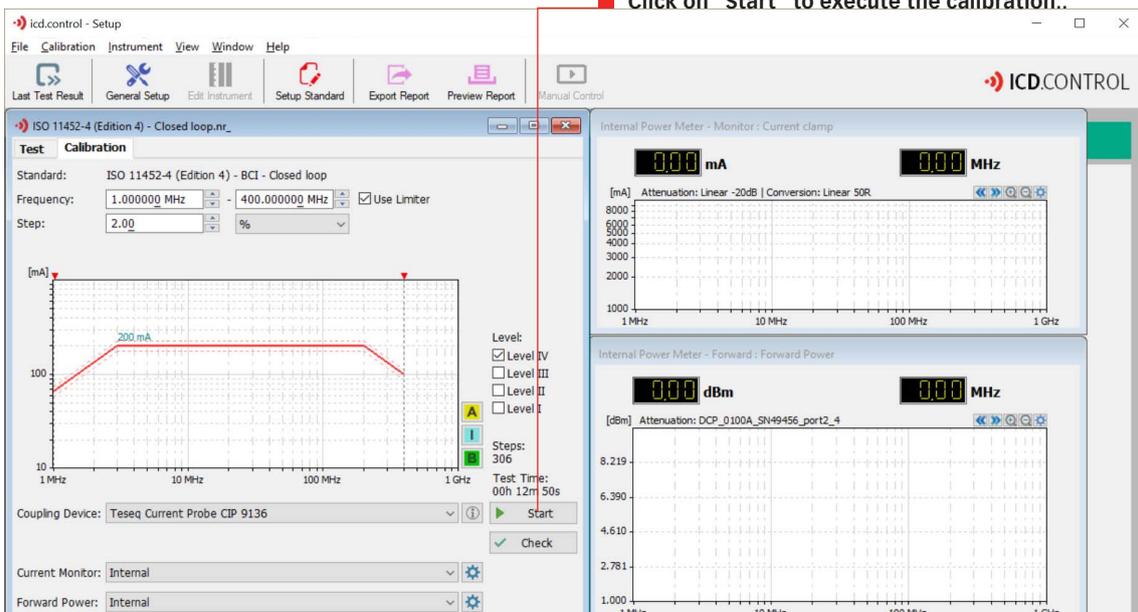
■ Select here the file which contains the correction data for the path used for measuring the forward power of the external directional coupler. Clicking on the icon  opens the file.

■ Click "OK" to save the settings.



■ Select here the file which contains the correction data for the path used for measuring the reverse power of the external directional coupler. Clicking on the icon  opens the file.

■ Click "OK" to save the settings.

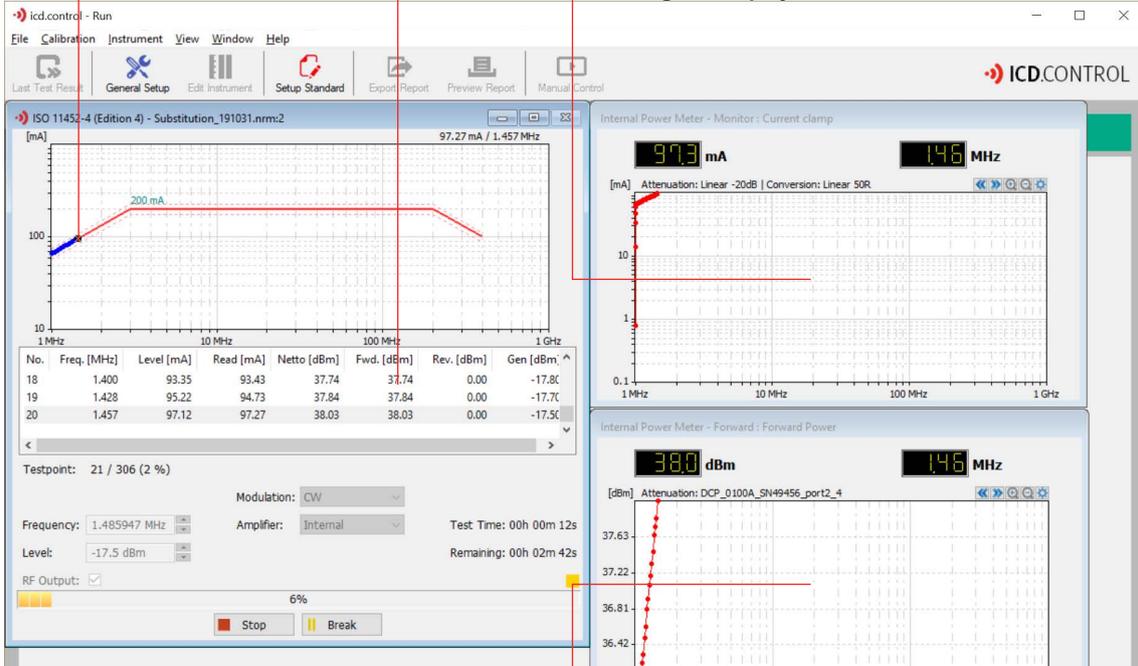


■ Click on "Start" to execute the calibration..

■ In the diagram, the achieved levels are displayed as blue dots and the target values as a red line.

■ Below the diagram, a table displays the values of frequency, target level, set level, net, forward, reverse (not used here) and generator power.

■ The Internal Power Meter - Monitor: Current Clamp Diagram displays the set levels.



■ The Internal Power Meter - Forward Power Diagram shows the required forward power for each level.

The Calibration Report dialog box shows the following information:

- Range: Frequency: 1 - 400 MHz, 2 %; Level: 200 mA
- Environment: Temperature: 23.0°C; Humidity: 46 %; Pressure: 988 mbar
- Coupling Device: Name: Teseq Current Probe CIP; Range: 0.01 - 400 MHz; SNo: [empty]
- Note: [empty]
- Description: [empty]

Buttons: Save, Cancel

■ After successful calibration, the operator is prompted to save the file.

■ A comment can be inserted.

■ Click "Save" to save the settings.

The Save calibration dialog box shows a list of existing calibration files and a text field for the file name.

Existing Calibration Files:

- Simulation BreakPoint FCC Probe F-120-6A, Level 2, Level 5, Level 5, 0\_01 - 200 MHz.cal
- Simulation BreakPoint FCC Probe F-120-6A, Level 3, Level 5, Level 5, 0\_01 - 200 MHz.cal
- Simulation BreakPoint FCC Probe F-120-6A, Level 5, Level 5, Level 5, 0\_01 - 200 MHz.cal
- Simulation BreakPoint Teseq Current Probe CIP 9136, Level 3, Level 4, Level 4, 0\_01 - 200 MHz.cal
- Simulation Teseq Current Probe CIP 9136, Level 5, Level 5, Level 5, 0\_01 - 200 MHz.cal
- Teseq Current Probe CIP 9136, Level 1, 0\_01 - 200 MHz\_190416.cal
- Teseq Current Probe CIP 9136, Level 1, 0\_01 - 200 MHz\_190417.cal
- Teseq Current Probe CIP 9136, Level 5, 0\_01 - 200 MHz.cal
- Teseq Current Probe CIP 9136, Navy\_fast, fast, 0\_004 - 1 MHz, 15\_0 %.cal
- Teseq Current Probe CIP 9136, Navy\_fast, fast, 0\_004 - 1 MHz, 15\_0 %\_181026\_failed.cal
- Teseq Current Probe CIP 9136, Navy\_fast, fast, 0\_004 - 1 MHz, 15\_0 %\_C60\_181106.cal
- Teseq Current Probe CIP 9136, Navy\_fast, fast, 0\_004 - 1 MHz, 15\_0 %\_C60\_181106\_2.cal
- Teseq Current Probe CIP 9136, Navy\_fast, fast, 0\_004 - 1 MHz, 15\_0 %\_C60\_181106\_6dB.cal

File Name: Teseq Current Probe CIP 9136, Level 5, 0\_01 - 200 MHz\_191031

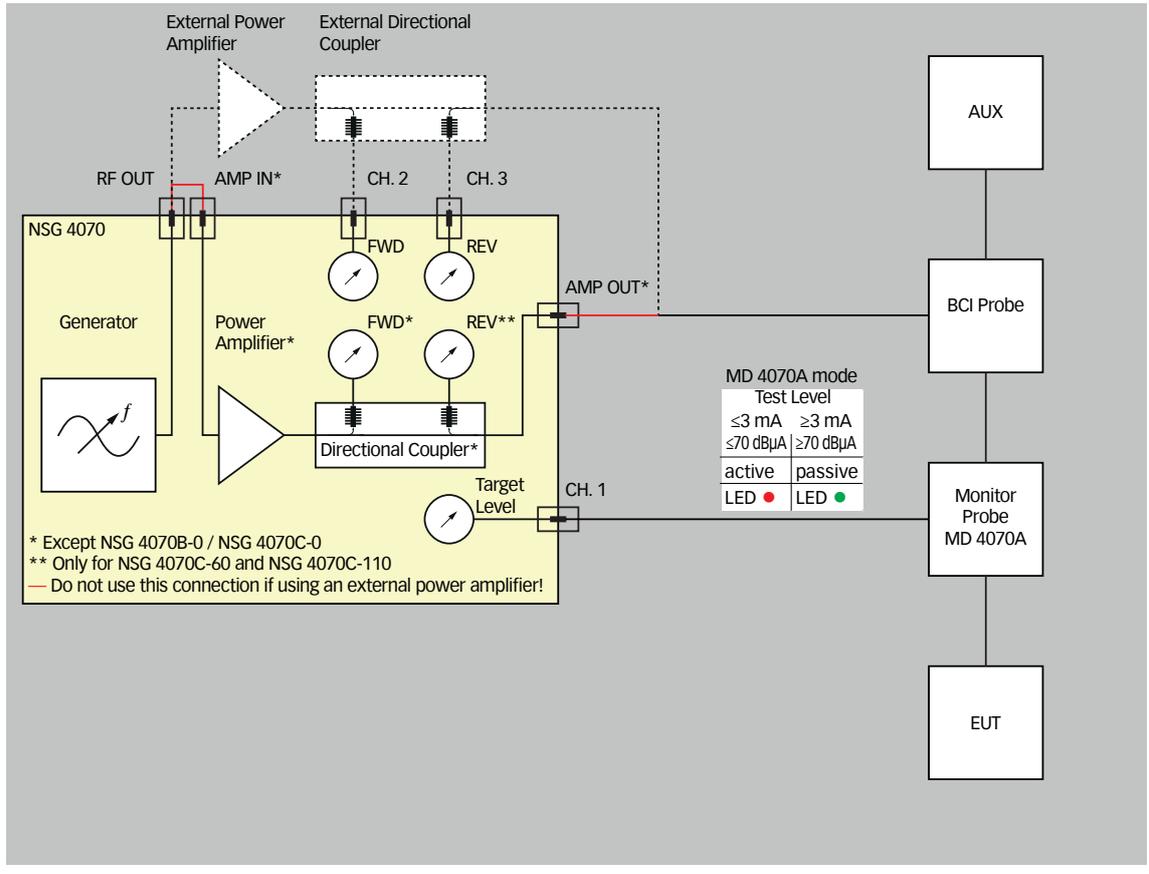
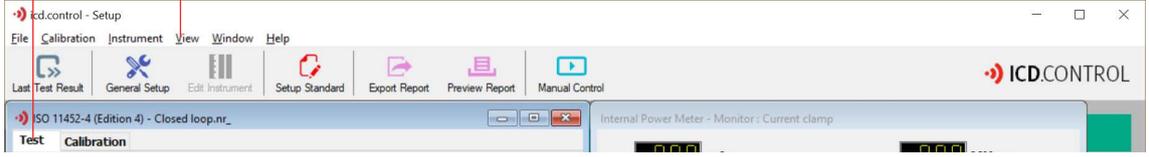
Buttons: Save, Cancel

■ A file name must be assigned.

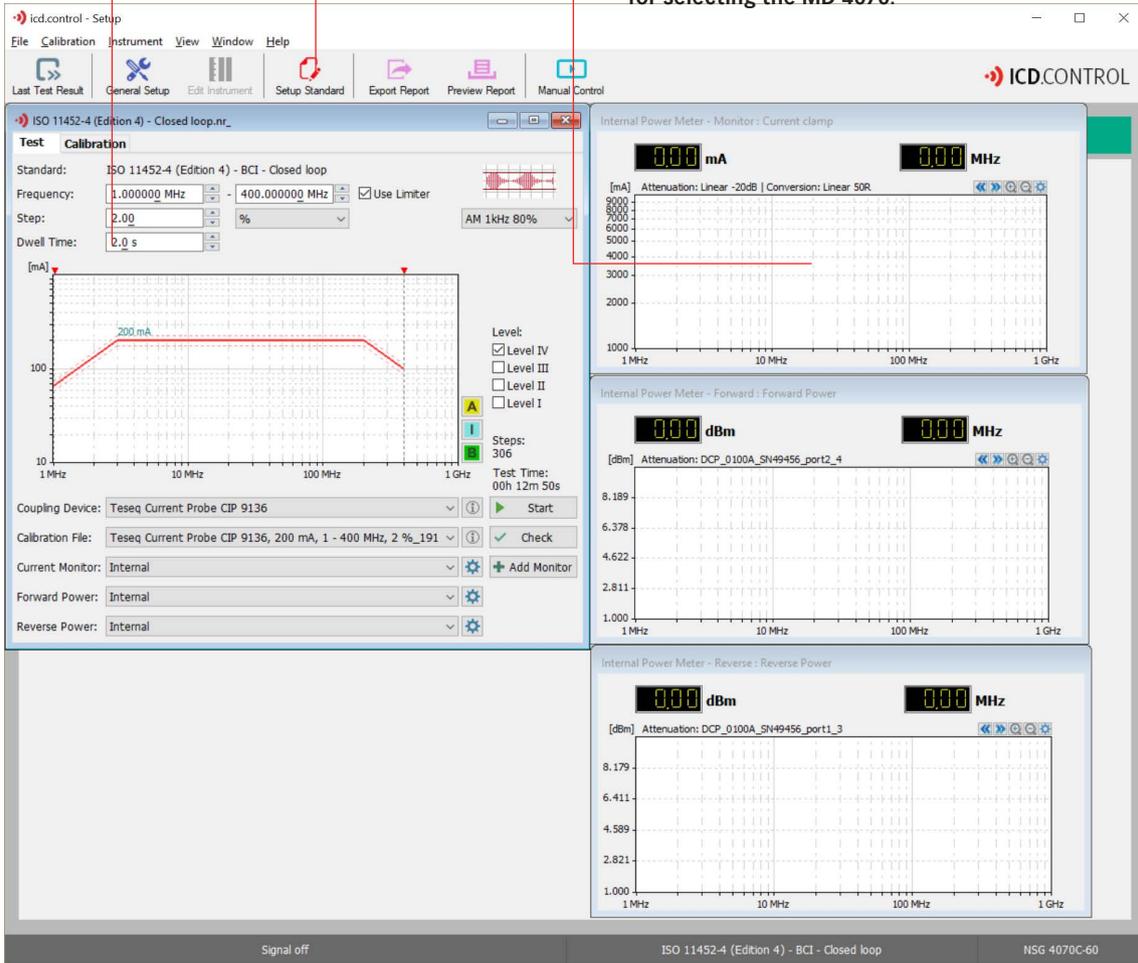
■ Click "Save" to save the calibration.

### 1.6. Test with the closed-loop method

- Immediately after calibration and saving the results, the program enters the test mode.
- Select "View" and "Show Test Setup" to display a sample image for the test setup.



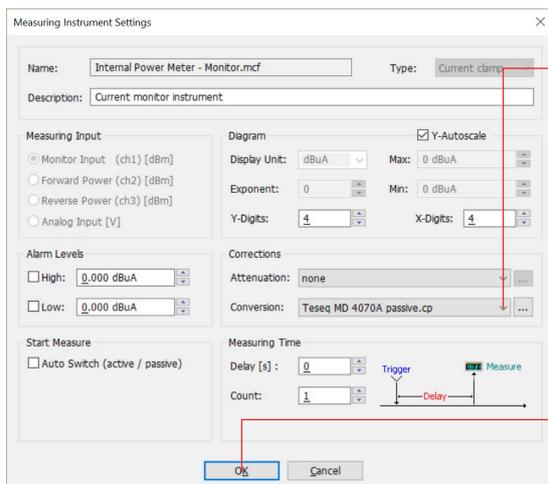
- Change the dwell time according to the standard specification.
- Change in "Setup standard" eg. the lowering of the level per frequency step according to the standard specification. Click on the edge of the window if the "Setup Standard" switch is greyed out.
- A double click into the diagram or a simple click on the settings symbol  opens the following menu for selecting the MD 4070.



The screenshot shows the ICD.CONTROL software interface for setting up an ISO 11452-4 test. The main window is titled "ISO 11452-4 (Edition 4) - Closed loop.nr.". It features a menu bar (File, Calibration, Instrument, View, Window, Help) and a toolbar with icons for Last Test Result, General Setup, Edit Instrument, Setup Standard, Export Report, Preview Report, and Manual Control. The main area is divided into several sections:

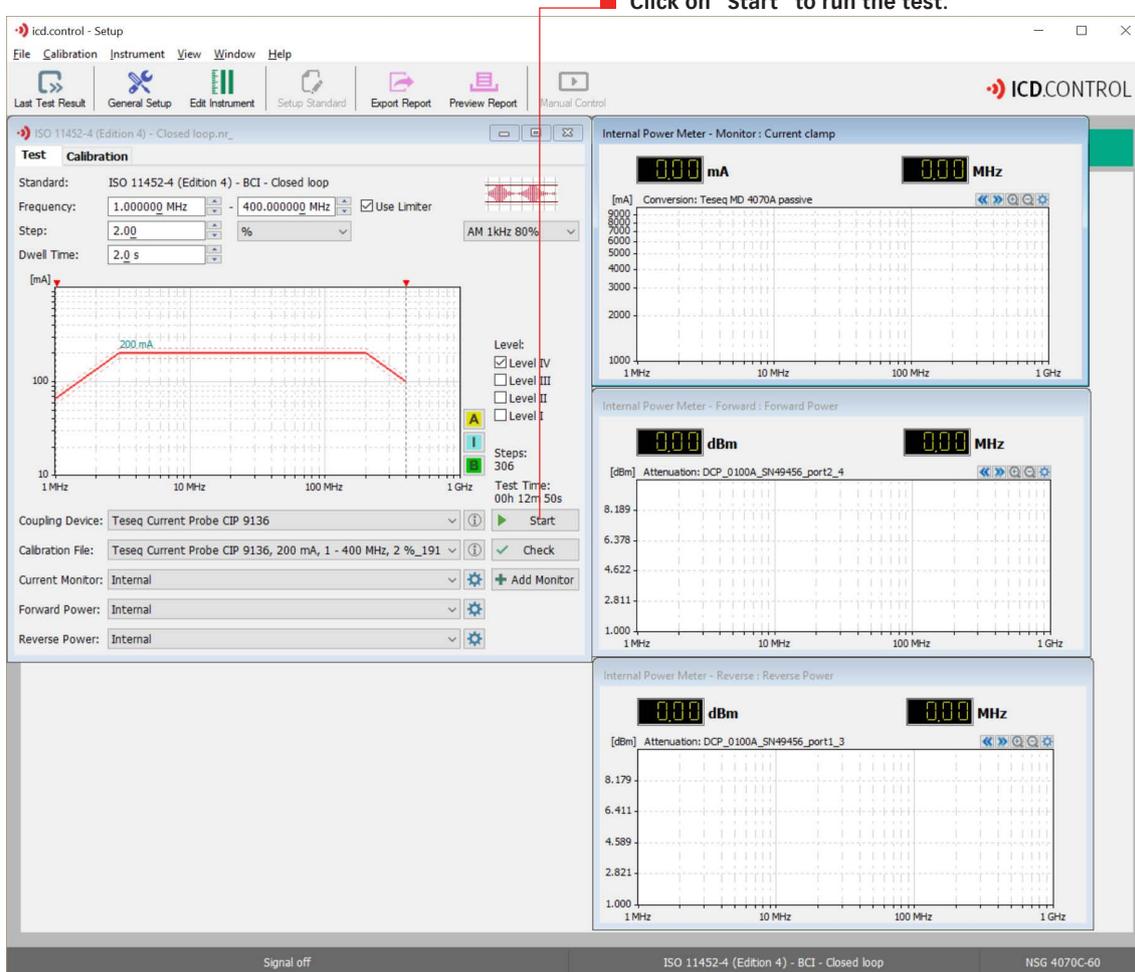
- Test Calibration:** Shows the standard "ISO 11452-4 (Edition 4) - BCI - Closed loop". Parameters include Frequency (1.000000 MHz to 400.000000 MHz), Step (2.00 %), and Dwell Time (2.0 s). A graph shows a current level of 200 mA across the frequency range. The "Setup Standard" button is greyed out.
- Internal Power Meter - Monitor: Current clamp:** Displays a graph of current in mA vs frequency in MHz. The current level is 200 mA.
- Internal Power Meter - Forward: Forward Power:** Displays a graph of power in dBm vs frequency in MHz. The power level is 0.00 dBm.
- Internal Power Meter - Reverse: Reverse Power:** Displays a graph of power in dBm vs frequency in MHz. The power level is 0.00 dBm.

Red arrows from the text instructions point to the "Dwell Time" field, the "Setup Standard" button, and the graph area.

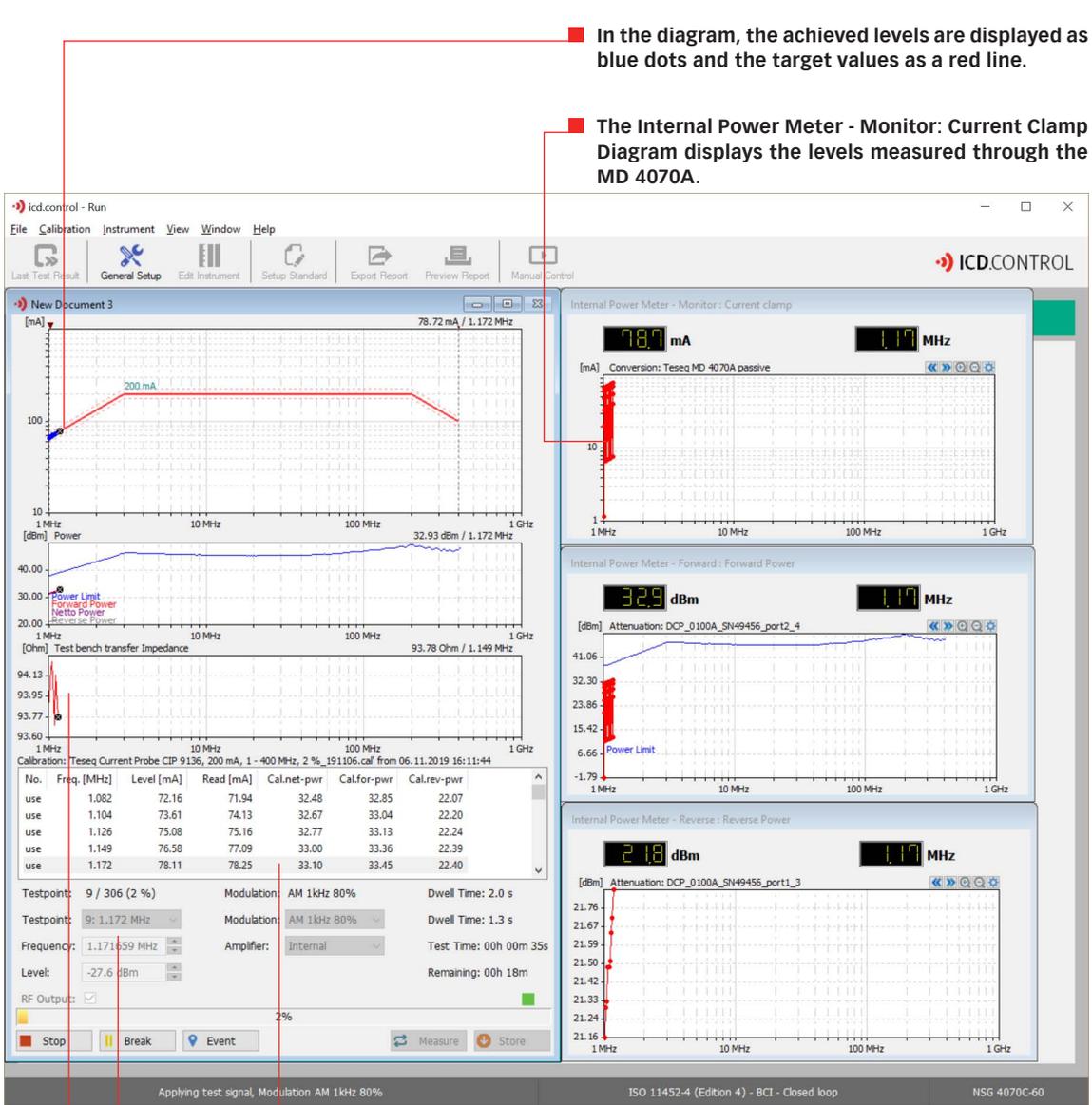


Select here the file containing the correction data of the MD 4070A for the passive mode. Clicking on the icon  opens the file.

Click "OK" to save the settings.



Click on "Start" to run the test.



In the diagram, the achieved levels are displayed as blue dots and the target values as a red line.

The Internal Power Meter - Monitor: Current Clamp Diagram displays the levels measured through the MD 4070A.

The table shows the currently used values of the calibration file.

The status area displays the test time, remaining test time, dwell time, and the status of the modulation and level. The button Break can be used to switch directly to the manual mode, for example, to check at a specific frequency with lowered level.

The diagram "Test bench transfer impedance" shows the current impedance of the test setup. A value of 100 ohms represents the same ratios as previously calibrated. Values above 100 ohms increase the output power up to a limit of four times the calibrated power.

## 1.7. Test end and report creation

Test Event: Finish

Level: 99.5 mA

Frequency: 400.000 MHz

Dwell Time: 2.0 s

Comment \ Index: 5

Save Close

■ The completion of the test run is indicated by the appearance of the "Test Event" window.

■ A comment can be inserted.

■ By clicking "Save" the generation of the test report is started.

Report Setup

Logo File (\*.bmp):

Test Center:

Test Engineer:

Customer:

Test Object:

Climatic Conditions

Temperature: 23 °C Pressure: 988 mbar

Humidity: 46 %

Standard: ISO 11452-4 (Edition 4) - BCI - Substitution

Port Description:

Comment:

Testreport No.:

Date of Test: October 31, 2019 4:14:51 pm

Result:

Test failed

Test passed

Setup Picture

Events

Test Points

Timestamp: [s]

Instruments: Diagram & Values

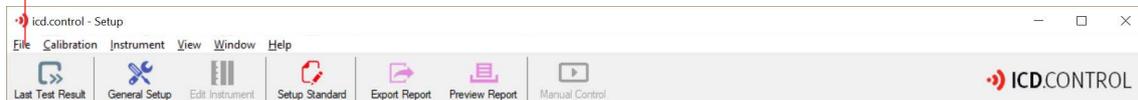
Load Save OK Cancel

■ Corresponding fields can be filled out and comments inserted.

■ Click on "OK" to apply the settings.

## 1.8. Save the configuration

■ By clicking on "File", "Save as" and assigning a file name, the settings are applied.



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