



SOFTWARE FOR EMC IMMUNITY TESTING ICD.CONTROL

**APPLICATION NOTE
IEC 61000-4-39**

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IEC 61000-4-39**

This application note requires icd.control version 7.1.1
or newer.

CONTENT

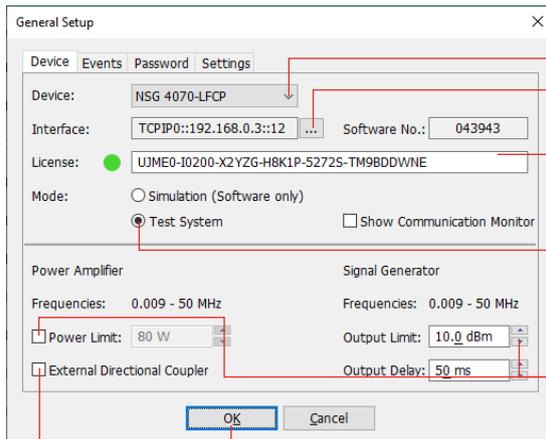
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1. EXAMPLE IEC 61000-4-39 LF TEST WITH NSG 4070C-LFCP

1.1. Basic settings

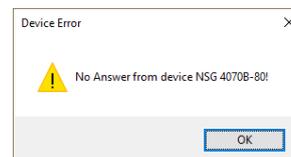


- Clicking on "General Setup" opens the generator settings menu.



- 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.

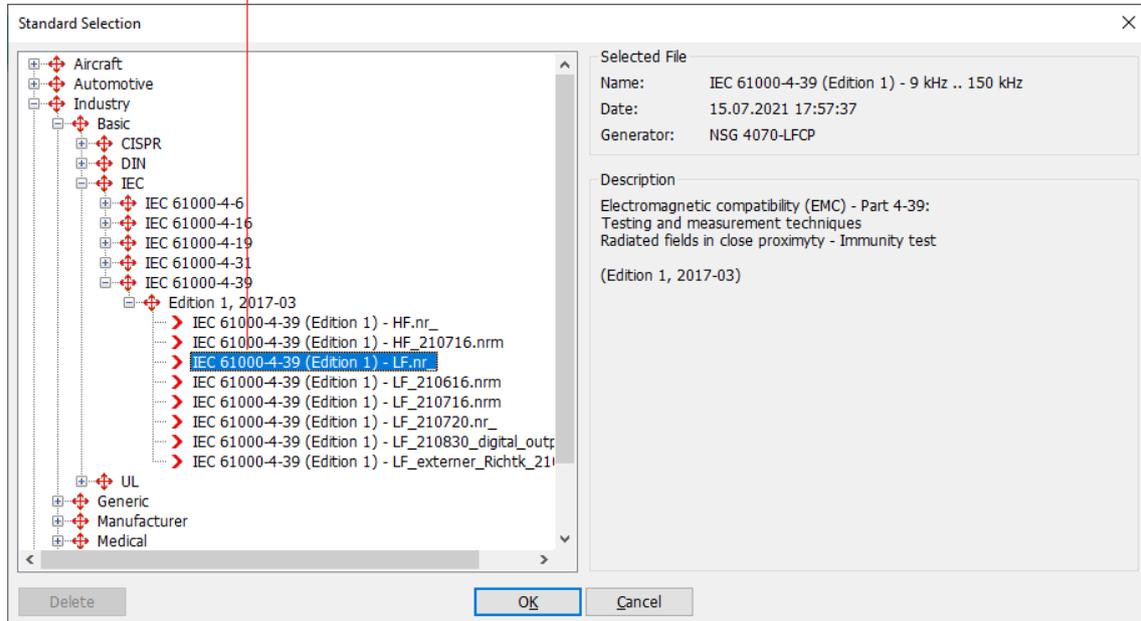
- If the hacking is set, the NSG 4070 expects the forward power at channel 2. For operation with the internal power amplifier and internal directional coupler, the hook must not be set.

1.2. Selecting and loading the test configuration



Click here to open the library.

Click here to open the configuration.



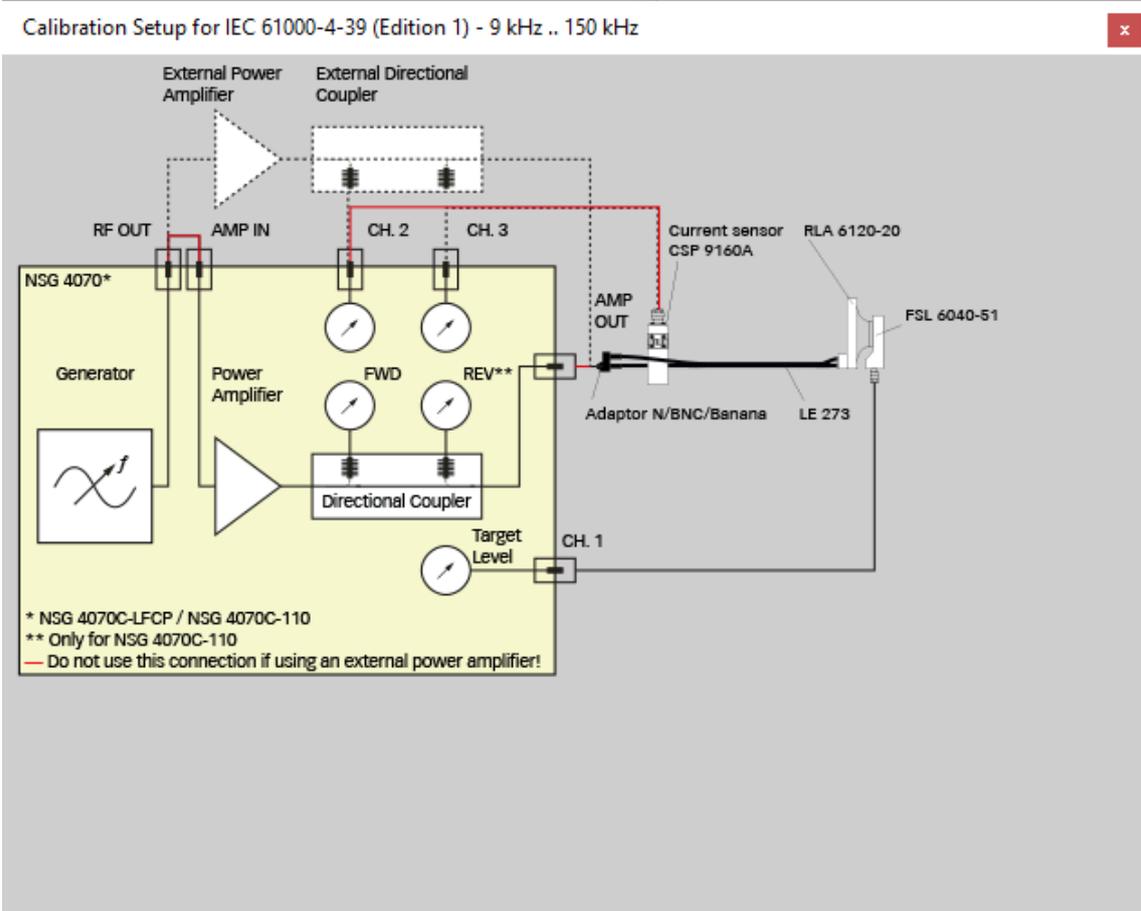
1.3. Calibration (test level adjustment)

- Select "Calibration" to set the test level setting for the connected hardware.
- Select "Setup Standard" to change the basic settings for this test. See the example below.
- Select here the LAS 6120.

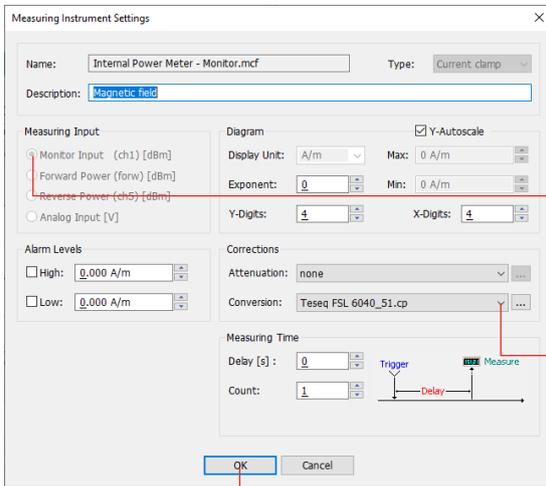
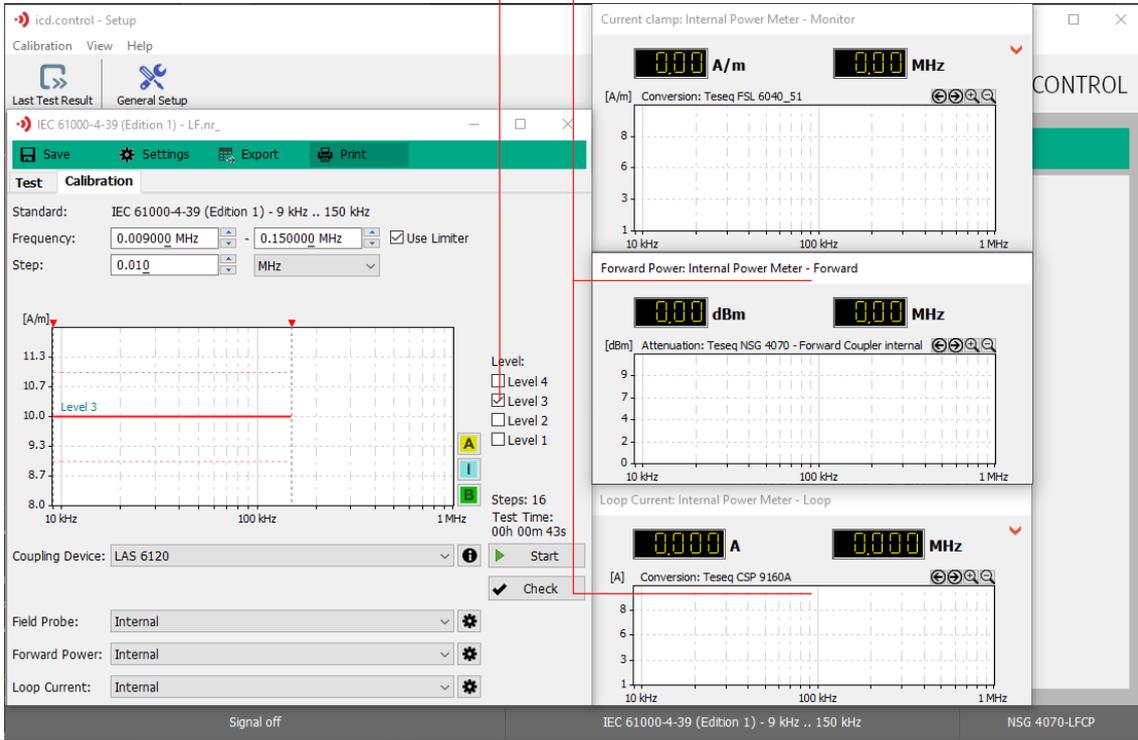
- Choose "Calibration".
- With a value of, for example, -6 dB, the level would be lowered by 6 dB at each frequency step and then gradually increased to the target level. A level reduction may be required by the standard. During calibration (procedure for setting the test level) these requirements do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

- Click "OK" to save the settings.

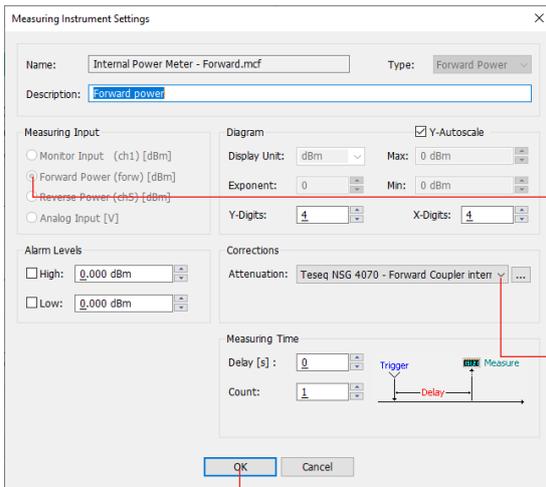
■ Select "View" and "Show Test Setup" to display a sample image for the test setup.



- Set the test level.
- A double-click into the diagram opens the following menus.



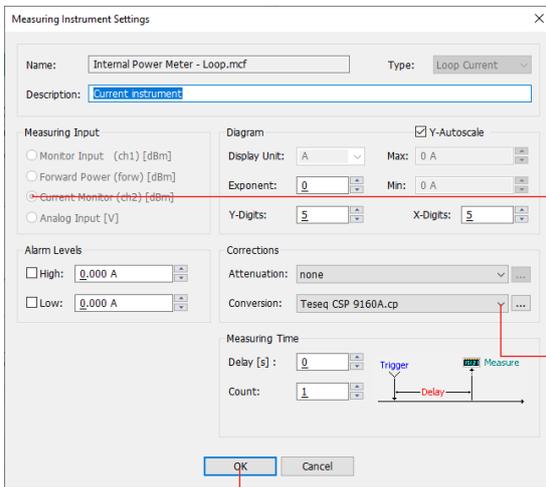
- Please note, this window is valid for power meter channel 1. It means, the sensor loop needs to be connected to power meter channel 1.
- Select here the file which contains the correction data for the loop sensor. Clicking on the icon  opens the file.
- Click "OK" to save the settings.



■ Please note, this window is valid for the internal power meter, which is used for measuring the forward power.

■ Select here the file Teseq NSG 4070 - Forward Coupler internal.los. The correction data is automatically updated at calibration or test start.

■ Click "OK" to save the settings.



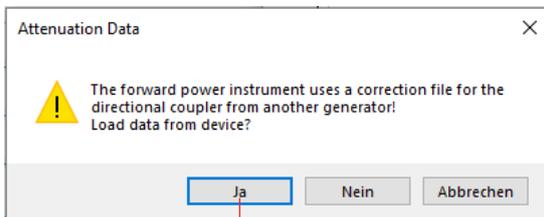
■ Please note, this window is valid for power meter channel 2. It means, the current clamp needs to be connected to power meter channel 2.

■ Select here the file which contains the correction data for the current clamp. Clicking on the icon ... opens the file.

■ Click "OK" to save the settings.

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

The screenshot shows the 'icd.control - Setup' interface. The main window is titled 'IEC 61000-4-39 (Edition 1) - LF.nr.'. It has a 'Calibration' tab selected. The test parameters are: Standard: IEC 61000-4-39 (Edition 1) - 9 kHz .. 150 kHz, Frequency: 0.009000 MHz to 0.150000 MHz, Step: 0.010 MHz, and Coupling Device: LAS 6120. A graph shows a red line at Level 3. On the right, three monitoring windows show 'Current clamp', 'Forward Power', and 'Loop Current' with digital readouts and graphs. A 'Start' button is visible in the main window.



■ Click "Yes" to load the directional coupler from the NSG 4070 to the file Teseq NSG 4070 - Forward Coupler internal.los.

- 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, read level, loop level, forward power and generator power.
- The instrument shows the measured magnetic field strength with the loop sensor.



- The instrument shows the measured current.
- The instrument shows the measured forward power.

Calibration Report

Range
 Frequency: 0.009 - 0.15 MHz, 0.01 MHz
 Level: Level 3

Environment
 Temperature: 23 °C
 Humidity: 46 %
 Pressure: 988 mbar

Coupling Device
 Name: LAS 6120
 Range: 0.009 - 0.15 MHz
 SNo:
 Note:
 Description:

Save Cancel

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

■ A comment can be inserted.

■ Click "Save" to save the settings.

Save calibration

Existing Calibration Files:

- LAS 6100, Level 3, 0_15 - 26 MHz_210716.cal
- LAS 6100, Level 4, 0_15 - 26 MHz_210716.cal
- LAS 6100, Level 4, 0_15 - 26 MHz_210716_2.cal
- LAS 6100, Level 4, 0_15 - 26 MHz_210722.cal
- LAS 6100, Level 4, 0_15 - 26 MHz_210913.cal
- LAS 6100, Level 4, 0_15 - 26 MHz_210917.cal
- LAS 6100, Level 4, 0_15 - 26 MHz_210917_2.cal
- LAS 6100, Level 4, 0_15 - 26 MHz_fehlerhaft_210716.cal
- LAS 6120, Level 1, 0_009 - 0_15 MHz, 0_01 MHz_210629.cal
- LAS 6120, Level 3, 0_009 - 0_15 MHz, 0_01 MHz_110_210831.cal
- LAS 6120, Level 3, 0_009 - 0_15 MHz, 0_01 MHz_210714.cal
- LAS 6120, Level 3, 0_009 - 0_15 MHz, 0_01 MHz_210716.cal
- LAS 6120, Level 3, 0_009 - 0_15 MHz, 0_01 MHz_210720.cal

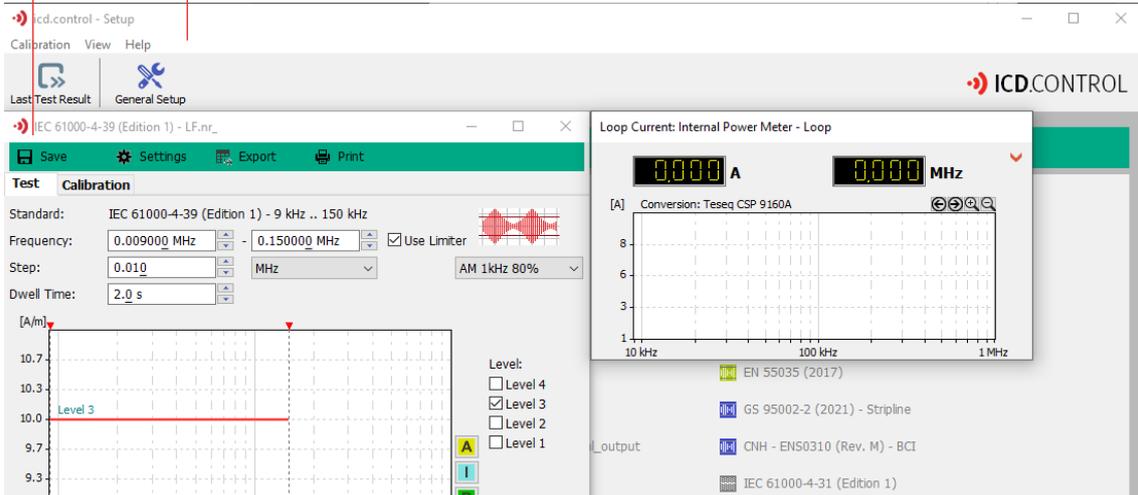
File Name:
 LAS 6120, Level 3, 0_009 - 0_15 MHz, 0_01 MHz_210923

Save Cancel

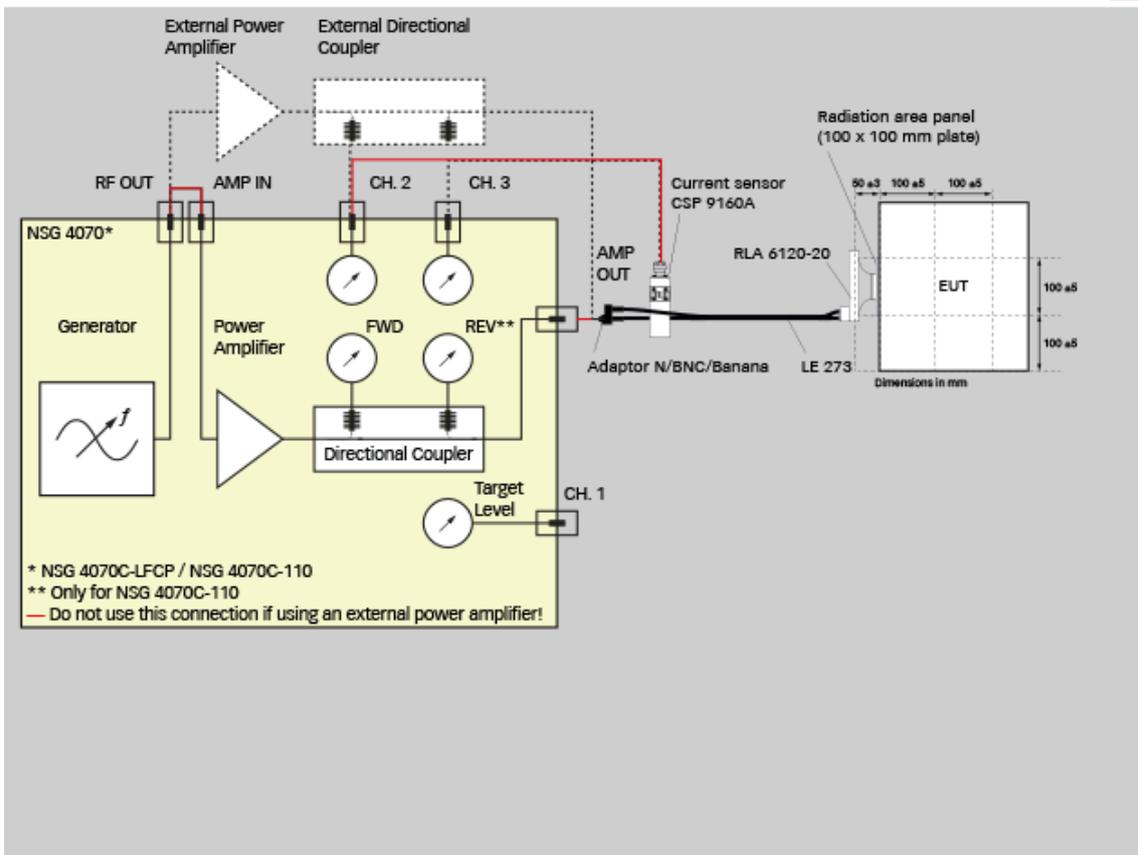
■ A file name must be assigned.

■ Click "Save" to save the calibration.

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



Test Setup for IEC 61000-4-39 (Edition 1) - 9 kHz .. 150 kHz



■ 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.

■ Change the dwell time according to the standard specification.

■ A double click into the diagram opens the following menu for selecting the current probe.

The screenshot displays the ICD.CONTROL software interface. The main window is titled "IEC 61000-4-39 (Edition 1) - LF..." and shows calibration parameters:

- Standard: IEC 61000-4-39 (Edition 1) - 9 kHz .. 150 kHz
- Frequency: 0.009000 MHz to 0.150000 MHz
- Step: 0.010 MHz
- Dwell Time: 2.0 s
- Use Limiter:
- AM 1kHz 80%

A graph on the left shows the level in A/m versus frequency in kHz, with a red line indicating "Level 3". The graph has a logarithmic x-axis from 10 kHz to 1 MHz and a linear y-axis from 9.0 to 10.7. To the right of the graph are level selection checkboxes:

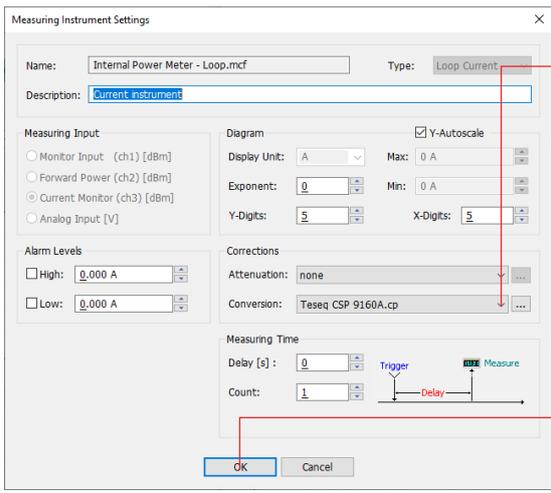
- Level 4
- Level 3
- Level 2
- Level 1

Below the graph, there are fields for "Coupling Device" (LAS 6120), "Calibration File" (LAS 6120, Level 3, 0_009 - 0_15 MHz, 0_01 MHz_2109), and "Loop Current" (Internal). Buttons for "Start", "Check", and "Add Monitor" are also visible.

An overlay window titled "Loop Current: Internal Power Meter - Loop" is open, showing a graph of current [A] versus frequency [kHz]. The graph has a logarithmic x-axis from 10 kHz to 1 MHz and a linear y-axis from 1 to 8. A red horizontal line is drawn at approximately 6.5 A. Below the graph is a list of standards for selection:

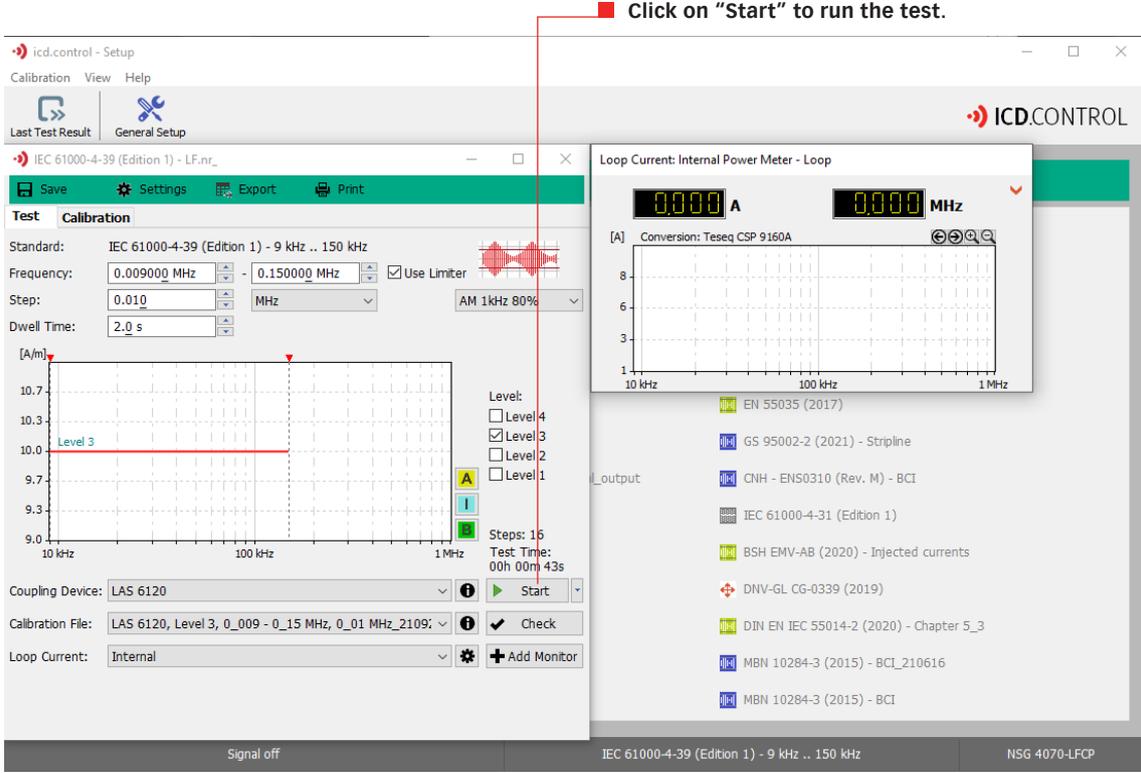
- EN 55035 (2017)
- GS 95002-2 (2021) - Stripline
- CNH - ENS0310 (Rev. M) - BCI
- IEC 61000-4-31 (Edition 1)
- BSH EMV-AB (2020) - Injected currents
- DNV-GL CG-0339 (2019)
- DIN EN IEC 55014-2 (2020) - Chapter 5_3
- MBN 10284-3 (2015) - BCI_210616
- MBN 10284-3 (2015) - BCI

Red lines in the original image connect the text instructions to the corresponding UI elements: the first instruction points to the "Setup Standard" switch, the second to the "Dwell Time" field, and the third to the graph area where the standard selection menu is opened.



■ Select here the file containing the correction data of the CSP 9160A. Clicking on the icon ... opens the file.

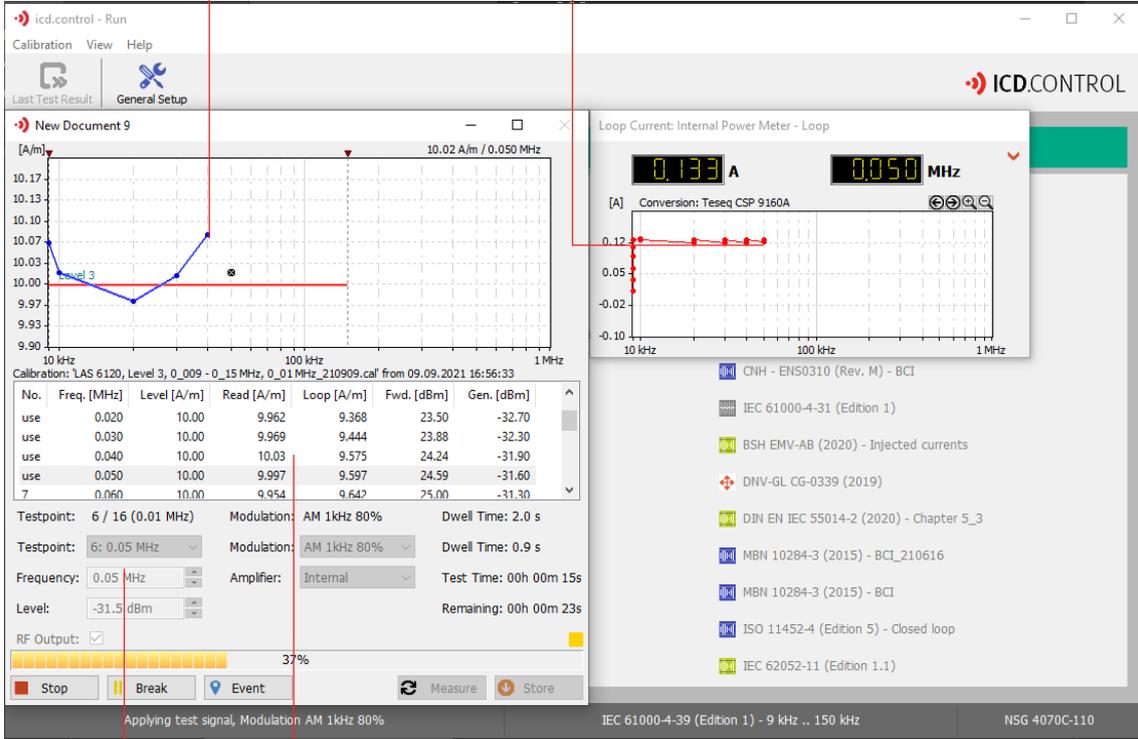
■ Click "OK" to save the settings.



■ 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 instrument displays the current measured through the CSP 9160A.



■ 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. Test end and report creation

■ 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.

■ Corresponding fields can be filled out and comments inserted.

■ Click on "OK" to apply the settings.

■ Give a proper file name and press "Save".

1.6. Save the configuration

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

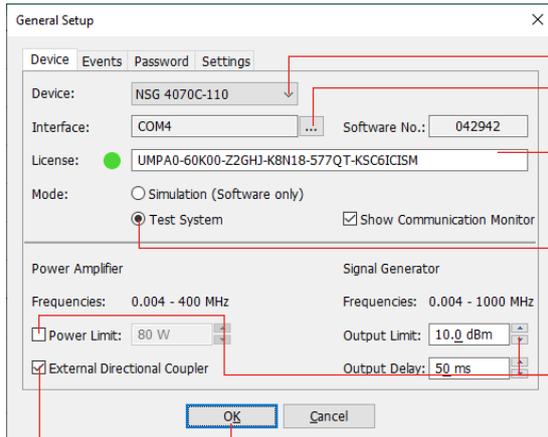


2. EXAMPLE IEC 61000-4-39 HF TEST WITH NSG 4070C-LFCP

2.1. Basic settings

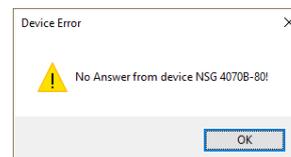


- Clicking on "General Setup" opens the generator settings menu.



- 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.

2.2. Selecting and loading the test configuration

The screenshot shows the 'icd.control' application window with a menu bar (File, Standards, Help) and a toolbar. A red arrow points from the 'Standards' menu to the 'Standard Selection' dialog box. Another red arrow points from the selected file in the dialog to the 'Click here to open the configuration.' text.

Click here to open the library.

Click here to open the configuration.

Standard Selection

Selected File

Name:	IEC 61000-4-39 (Edition 1) - 150 kHz .. 26 MHz
Date:	16.07.2021 15:14:45
Generator:	NSG 4070-LFCP

Description

Electromagnetic compatibility (EMC) - Part 4-39:
Testing and measurement techniques
Radiated fields in close proximity - Immunity test
(Edition 1, 2017-03)

Buttons: Delete, OK, Cancel

2.3. Calibration (test level adjustment)

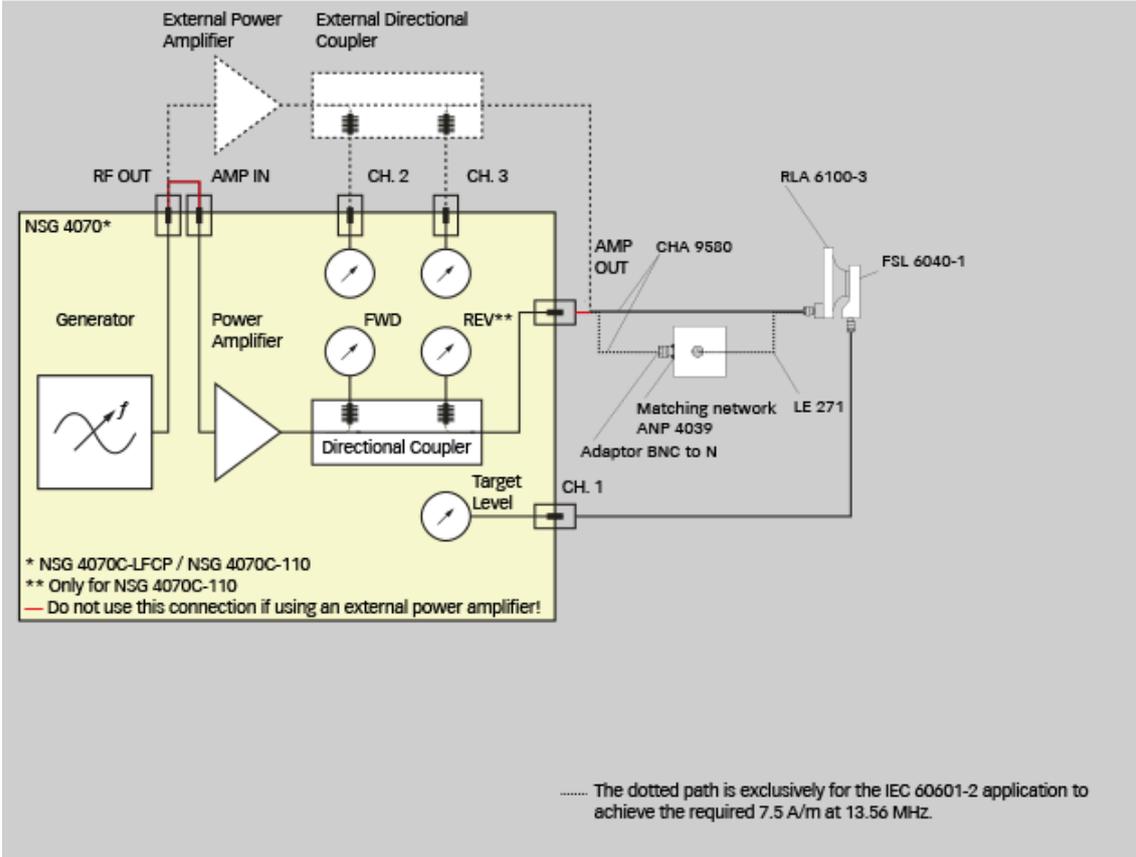
- Select "Calibration" to set the test level setting for the connected hardware.
- Select "Setup Standard" to change the basic settings for this test. See the example below.
- Select here the LAS 6100.

- 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.

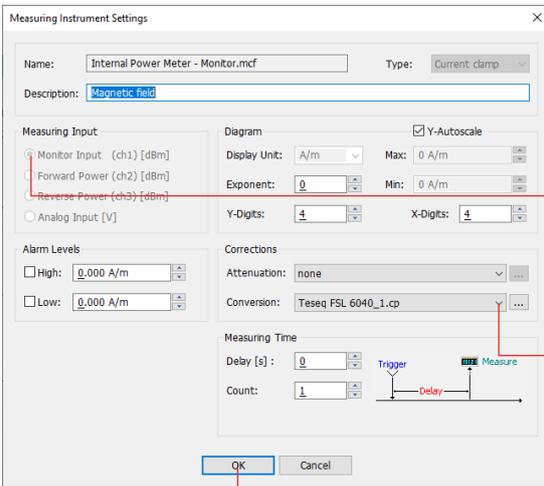
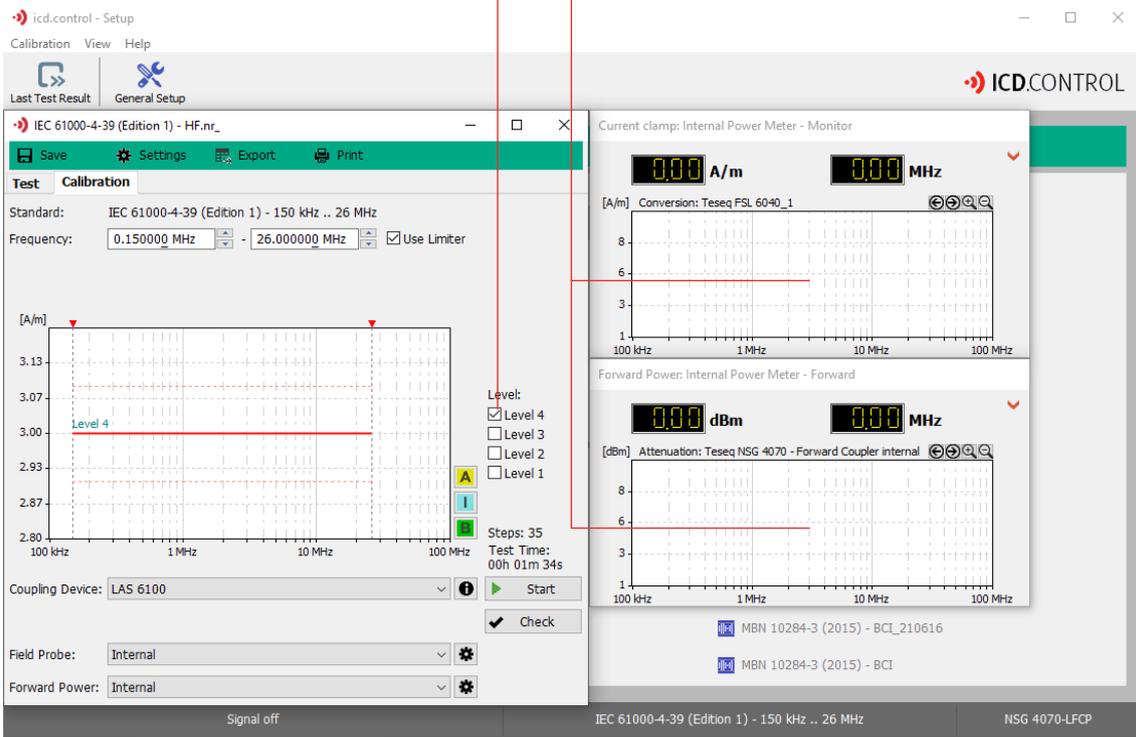
■ Select "View" and "Show Test Setup" to display a sample image for the test setup.



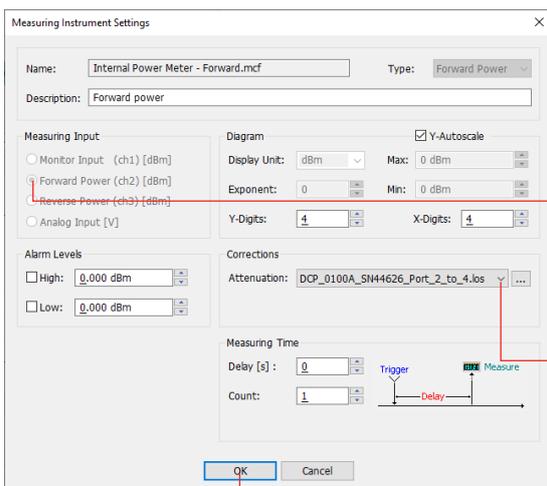
Calibration Setup for IEC 61000-4-39 (Edition 1) - 150 kHz .. 26 MHz



- Set the test level.
- A double-click into the diagram opens the following menus.



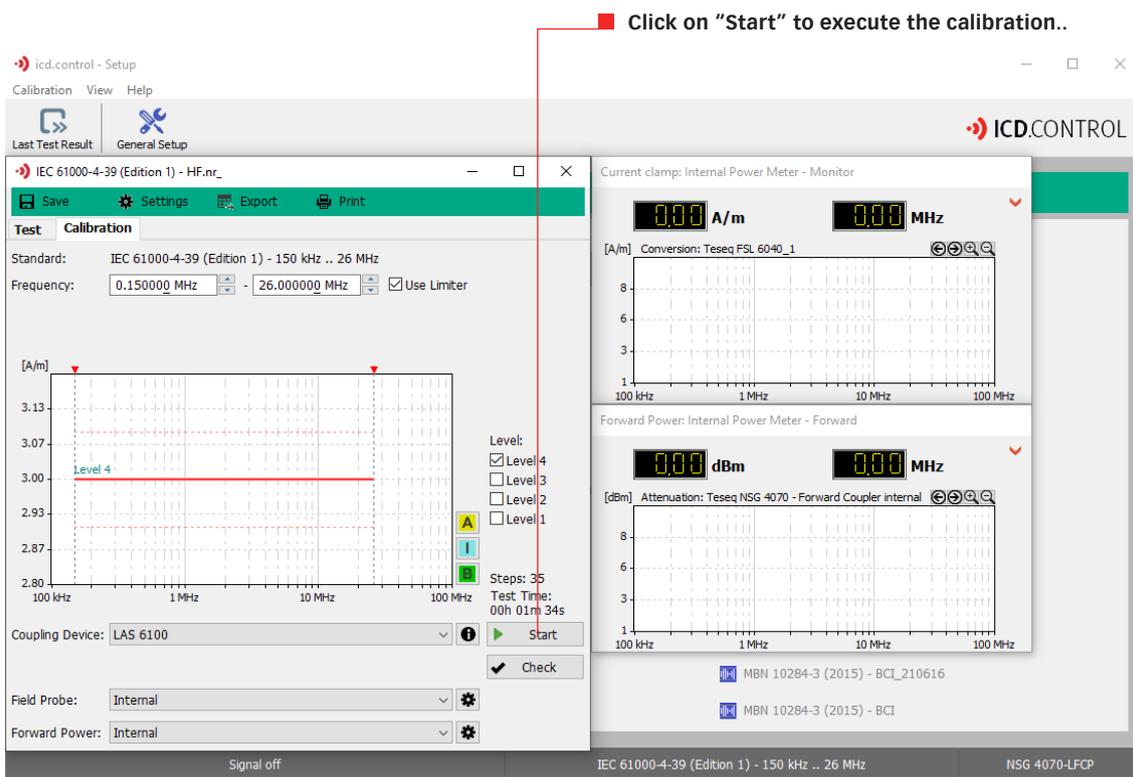
- Please note, this window is valid for power meter channel 1. It means, the sensor loop needs to be connected to power meter channel 1.
- Select here the file which contains the correction data for the loop sensor. Clicking on the icon  opens the file.
- Click "OK" to save the settings.



■ Please note, this window is valid for power meter channel 2. It means, the forward power port of the external directional coupler needs to be connected to power meter channel 2.

■ 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, read level, loop level, forward power and generator power.

■ The instrument shows the measured magnetic field strength with the loop sensor.



■ The instrument shows the measured forward power.

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

■ A comment can be inserted.

■ Click "Save" to save the settings.

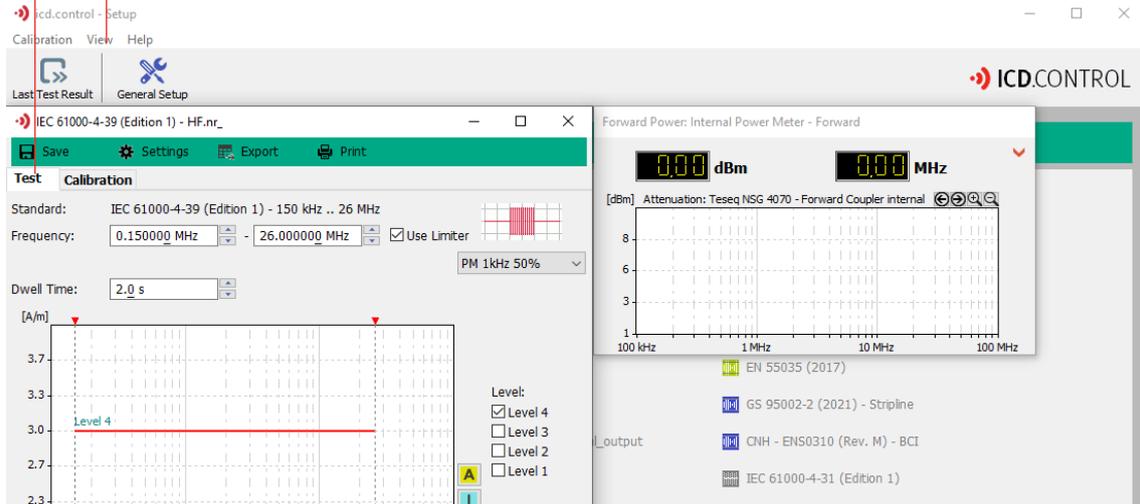
■ A file name must be assigned.

■ Click "Save" to save the calibration.

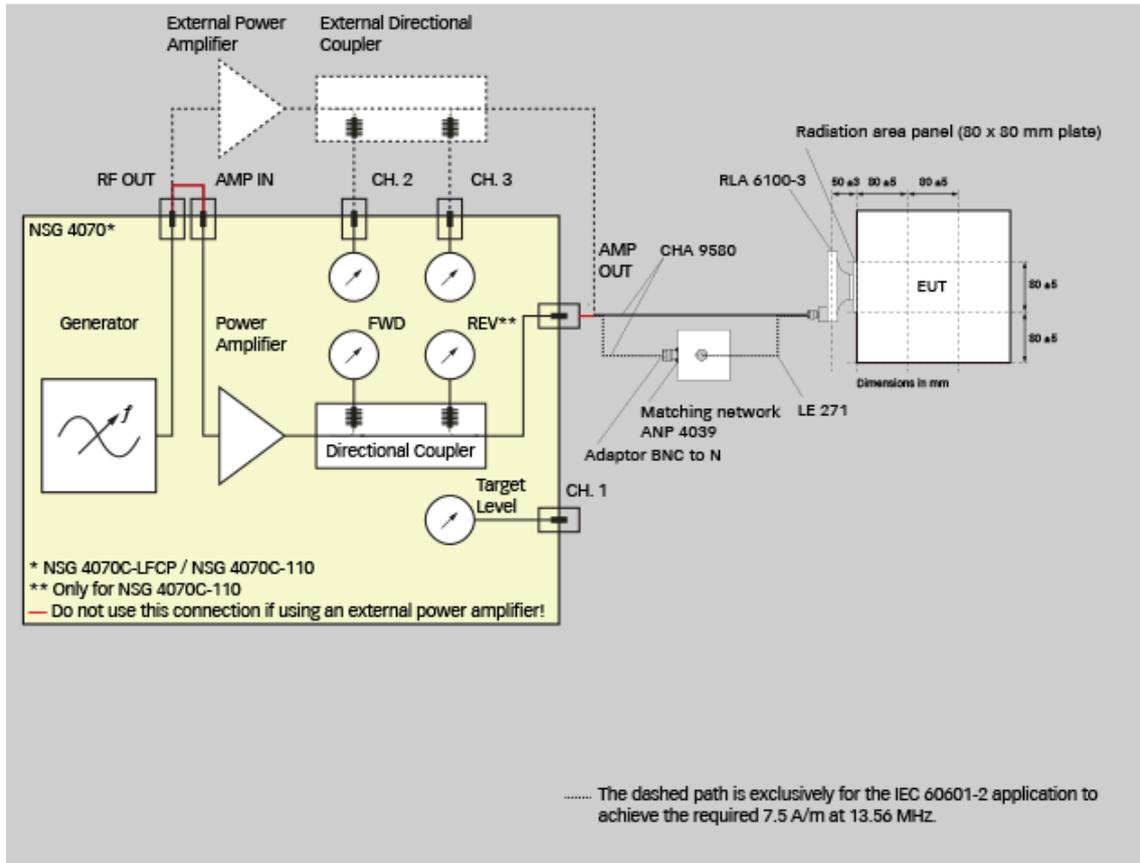
2.4. Test

■ Select "Test" to switch to the test mode.

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



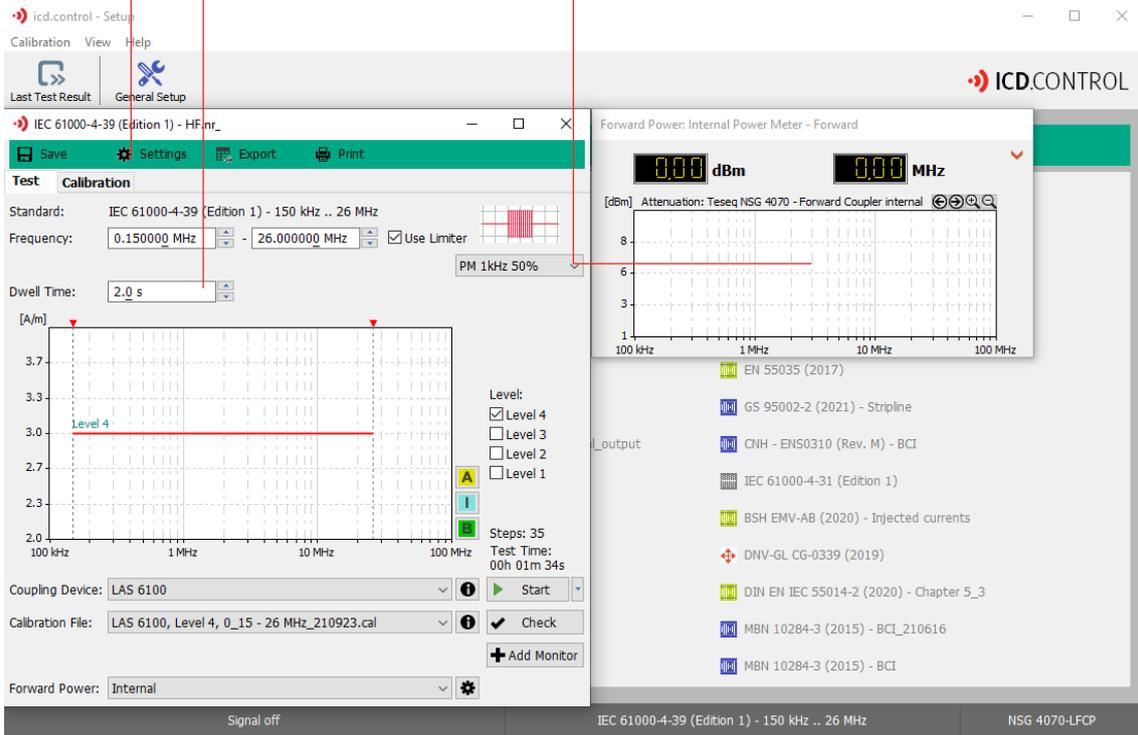
Test Setup for IEC 61000-4-39 (Edition 1) - 150 kHz .. 26 MHz

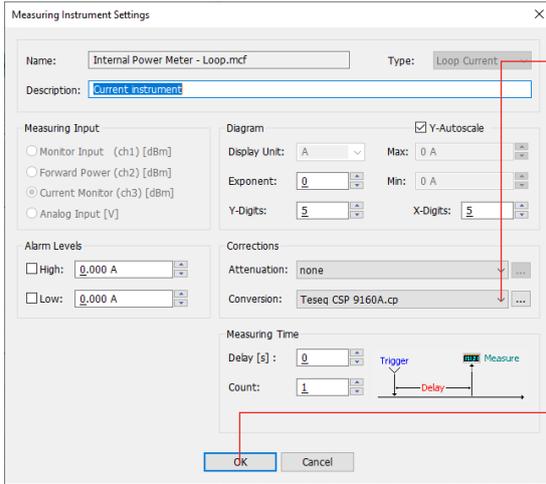


■ Change in "Setup standard" eg. the lowering of the level per frequency step according to the standard specification. Click on the edge of the window if the "Setup Standard" switch is greyed out.

■ Change the dwell time according to the standard specification.

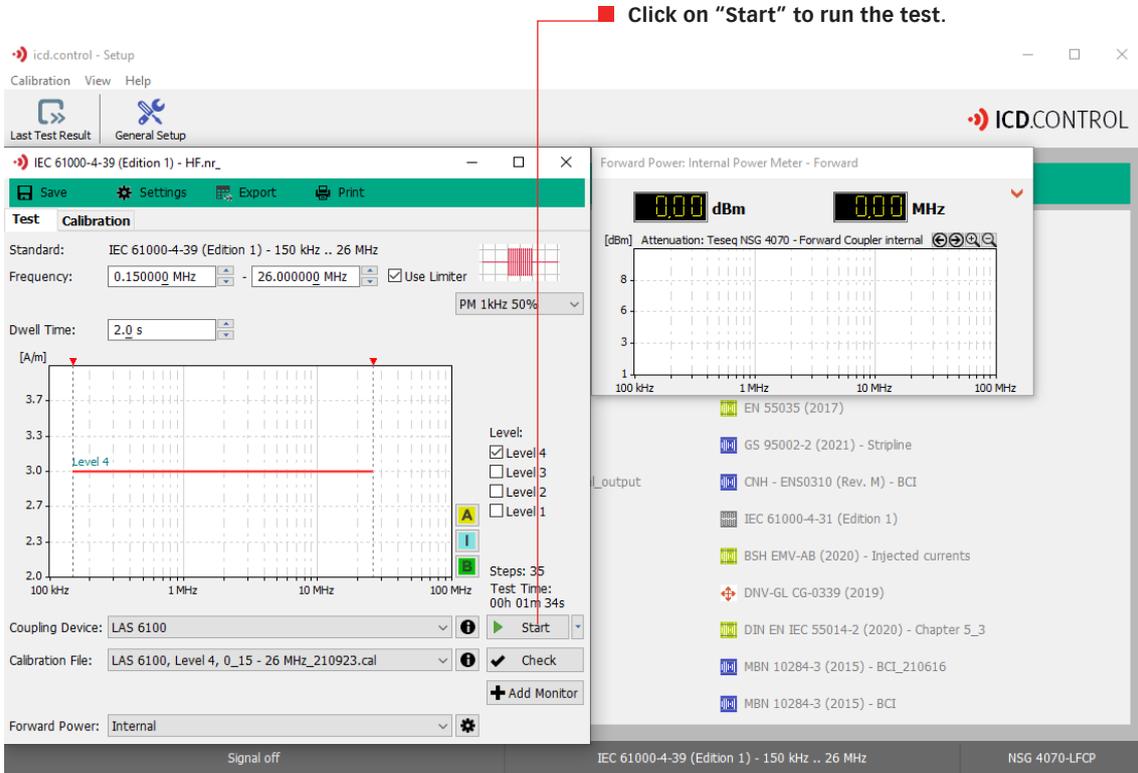
■ A double click into the diagram opens the following menu for selecting the current probe.





■ Select here the file containing the correction data of the CSP 9160A. 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 instrument displays the current measured through the CSP 9160A.

■ 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.

2.5. Test end and report creation

■ 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.

■ Corresponding fields can be filled out and comments inserted.

■ Click on "OK" to apply the settings.

■ Give a proper file name and press "Save".

2.6. Save the configuration

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

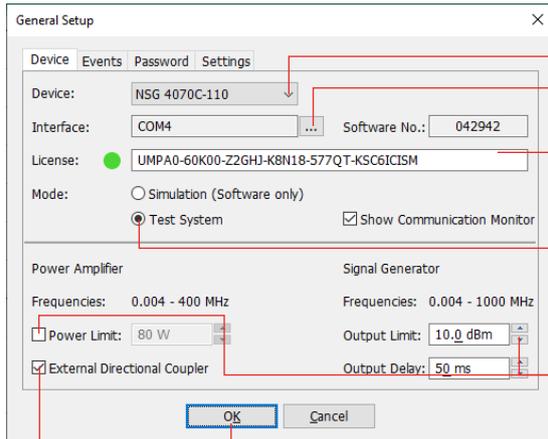


3. EXAMPLE IEC 61000-4-39 LF TEST WITH EXTERNAL DIRECTIONAL COUPLER AND AMPLIFIER

3.1. Basic settings

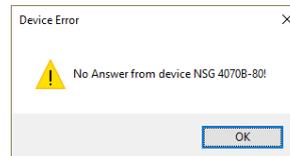


- Clicking on "General Setup" opens the generator settings menu.



- 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.

3.2. Selecting and loading the test configuration

icd.control
File Standards Help

Standard Test Vector Test Test Result Last Test Result General Setup Open Instrument Device Control Device Transfer

Click here to open the library.

Click here to open the configuration.

Standard Selection

- Aircraft
- Automotive
- Industry
 - Basic
 - CISPR
 - DIN
 - IEC
 - IEC 61000-4-6
 - IEC 61000-4-16
 - IEC 61000-4-19
 - IEC 61000-4-31
 - IEC 61000-4-39
 - Edition 1, 2017-03
 - IEC 61000-4-39 (Edition 1) - HF.nr_
 - IEC 61000-4-39 (Edition 1) - HF_210716.nrm
 - IEC 61000-4-39 (Edition 1) - LF.nr**
 - IEC 61000-4-39 (Edition 1) - LF_210616.nrm
 - IEC 61000-4-39 (Edition 1) - LF_210716.nrm
 - IEC 61000-4-39 (Edition 1) - LF_210720.nr_
 - IEC 61000-4-39 (Edition 1) - LF_210830_digital_outp
 - IEC 61000-4-39 (Edition 1) - LF_externer_Richtk_21

- UL
- Generic
- Manufacturer
- Medical

Delete OK Cancel

Selected File

Name: IEC 61000-4-39 (Edition 1) - 9 kHz .. 150 kHz
Date: 15.07.2021 17:57:37
Generator: NSG 4070-LFCP

Description

Electromagnetic compatibility (EMC) - Part 4-39:
Testing and measurement techniques
Radiated fields in close proximity - Immunity test
(Edition 1, 2017-03)

3.3. Calibration (test level adjustment)

- Select "Calibration" to set the test level setting for the connected hardware.
- Select "Setup Standard" to change the basic settings for this test. See the example below.
- Select here the LAS 6120.

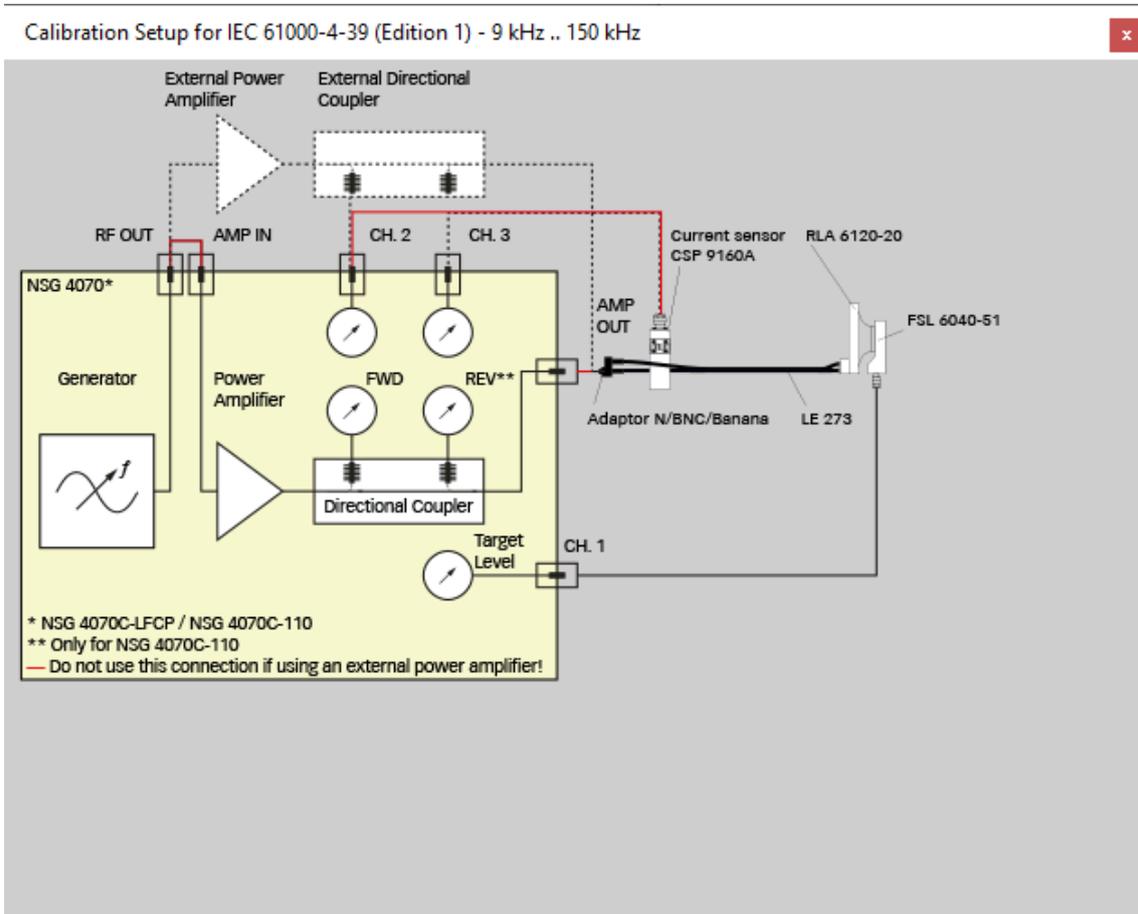
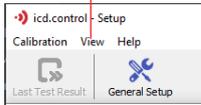
The screenshot shows the 'icd.control - Setup' window with the 'Calibration' tab selected. The 'Test' section is set to 'IEC 61000-4-39 (Edition 1) - 9 kHz .. 150 kHz'. The 'Frequency' is 0.009000 MHz and the 'Step' is 0.010 MHz. The 'Coupling Device' is set to 'LAS 6120'. A graph shows the test level at 10.0 A/m for Level 3. To the right, three monitoring graphs are visible: 'Current clamp: Internal Power Meter - Monitor' showing 6.34 A/m at 0.09 MHz, 'Forward Power: Internal Power Meter - Forward' showing 0.00 dBm at 0.00 MHz, and 'Loop Current: Internal Power Meter - Loop' showing 4.659 A at 0.060 MHz.

- 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.

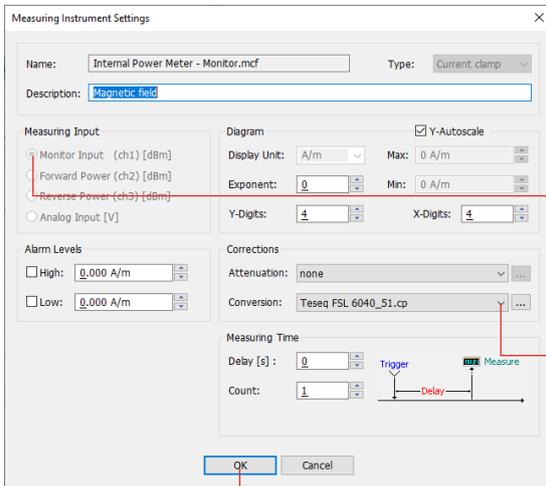
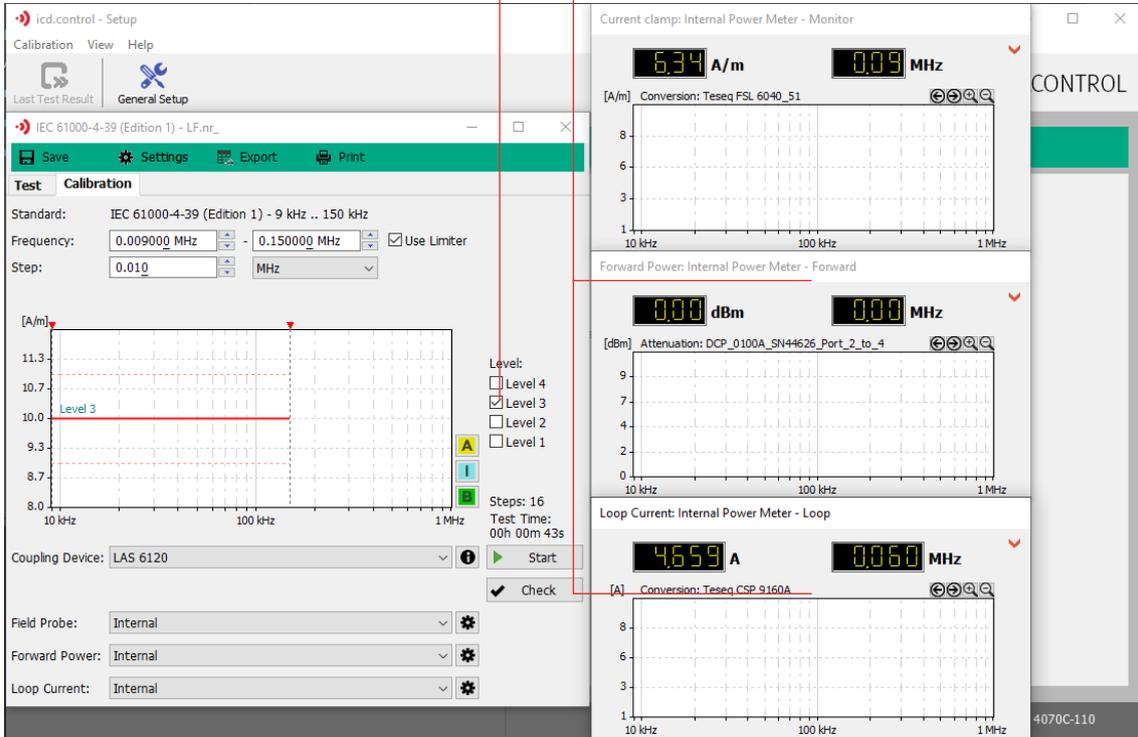
The 'Standard Setup' dialog box for 'Test: Calibration' is shown. It includes fields for 'Tolerance' (-10.0%), 'Level Change each Testpoint' (0.0 dB), 'Max Regulation Step' (26.0 dB), and 'Regulation Step Delay' (0.0 s). There are also checkboxes for 'Additional Level Offset' (0 dB), 'Check Level Consistency' (3 dB), and 'Diagram Autoscale' (checked). 'OK', 'Cancel', and 'Default' buttons are at the bottom.

- 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 opens the following menus.



- Please note, this window is valid for power meter channel 1. It means, the sensor loop needs to be connected to power meter channel 1.
- Select here the file which contains the correction data for the loop sensor. Clicking on the icon  opens the file.
- Click "OK" to save the settings.

■ Please note, this window is valid for power meter channel 2. It means, the forward power port of the external directional coupler needs to be connected to power meter channel 2.

■ 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.

■ Please note, this window is valid for power meter channel 3. It means, the current clamp needs to be connected to power meter channel 3.

■ Select here the file which contains the correction data for the current clamp. Clicking on the icon  opens the file.

■ Click "OK" to save the settings.

Click on "Start" to execute the calibration..

The screenshot displays the 'icd.control - Setup' software interface. The main window is titled 'IEC 61000-4-39 (Edition 1) - LF.nr.' and is in the 'Calibration' tab. The 'Test' section shows the following settings: Standard: IEC 61000-4-39 (Edition 1) - 9 kHz .. 150 kHz; Frequency: 0.009000 MHz to 0.150000 MHz; Step: 0.010 MHz; Use Limiter: checked. A graph shows a red line at Level 3 (10.0 A/m) on a log-log scale from 10 kHz to 1 MHz. The 'Coupling Device' is set to 'LAS 6120'. The 'Start' button is highlighted with a red arrow pointing to the instruction above. Below the main window are three monitoring windows: 'Current clamp: Internal Power Meter - Monitor' showing 6.34 A/m at 0.009 MHz; 'Forward Power: Internal Power Meter - Forward' showing 0.00 dBm at 0.00 MHz; and 'Loop Current: Internal Power Meter - Loop' showing 4.659 A at 0.060 MHz. The bottom right corner of the software interface shows the identifier '4070C-110'.

■ 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, read level, loop level, forward power and generator power.

■ The instrument shows the measured magnetic field strength with the loop sensor.



■ The instrument shows the measured current.

■ The instrument shows the measured forward power.

Calibration Report

Range		Environment	
Frequency:	0.009 - 0.15 MHz, 0.01 MHz	Temperature:	23 °C
Level:	Level 3	Humidity:	46 %
		Pressure:	988 mbar
Coupling Device		Note:	
Name:	LAS 6120	Description:	
Range:	0.009 - 0.15 MHz		
SNo:			
<input type="button" value="Save"/> <input type="button" value="Cancel"/>			

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

■ A comment can be inserted.

■ Click "Save" to save the settings.

Save calibration

Existing Calibration Files:

- LAS 6100, Level 3, 0.15 - 26 MHz_210716.cal
- LAS 6100, Level 4, 0.15 - 26 MHz_210716.cal
- LAS 6100, Level 4, 0.15 - 26 MHz_210716_2.cal
- LAS 6100, Level 4, 0.15 - 26 MHz_210722.cal
- LAS 6100, Level 4, 0.15 - 26 MHz_fehlerhaft_210716.cal
- LAS 6120, Level 1, 0.009 - 0.15 MHz, 0.01 MHz_210629.cal
- LAS 6120, Level 3, 0.009 - 0.15 MHz, 0.01 MHz_110_210831.cal
- LAS 6120, Level 3, 0.009 - 0.15 MHz, 0.01 MHz_210714.cal
- LAS 6120, Level 3, 0.009 - 0.15 MHz, 0.01 MHz_210716.cal
- LAS 6120, Level 3, 0.009 - 0.15 MHz, 0.01 MHz_210720.cal
- LAS 6120, Level 3, 0.009 - 0.15 MHz, 0.01 MHz_210722.cal
- LAS 6120, Level 3, 0.009 - 0.15 MHz, 0.01 MHz_210909.cal
- LAS 6120, Level 4, 0.009 - 0.15 MHz, 0.01 MHz_210716.cal

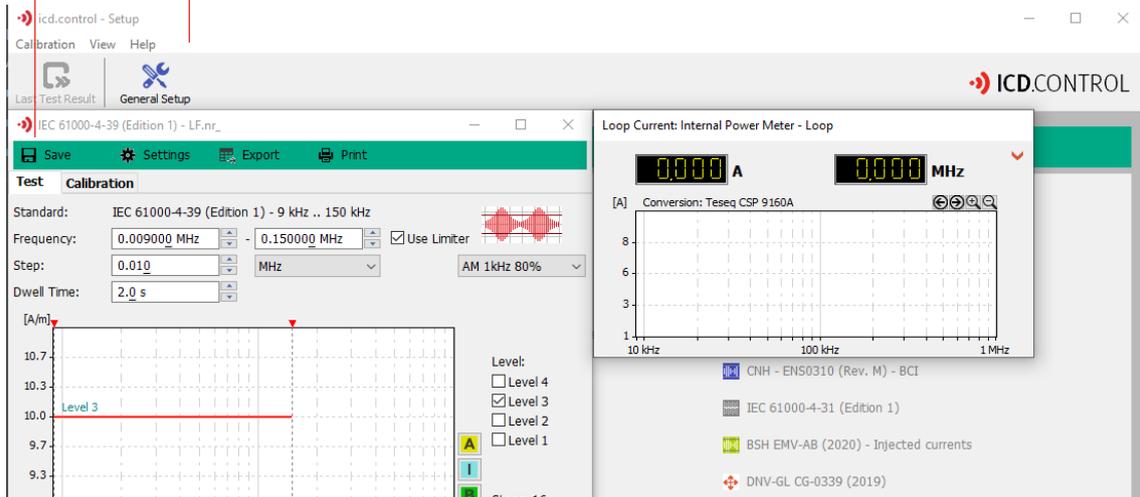
File Name:

LAS 6120, Level 3, 0.009 - 0.15 MHz, 0.01 MHz_210909_2

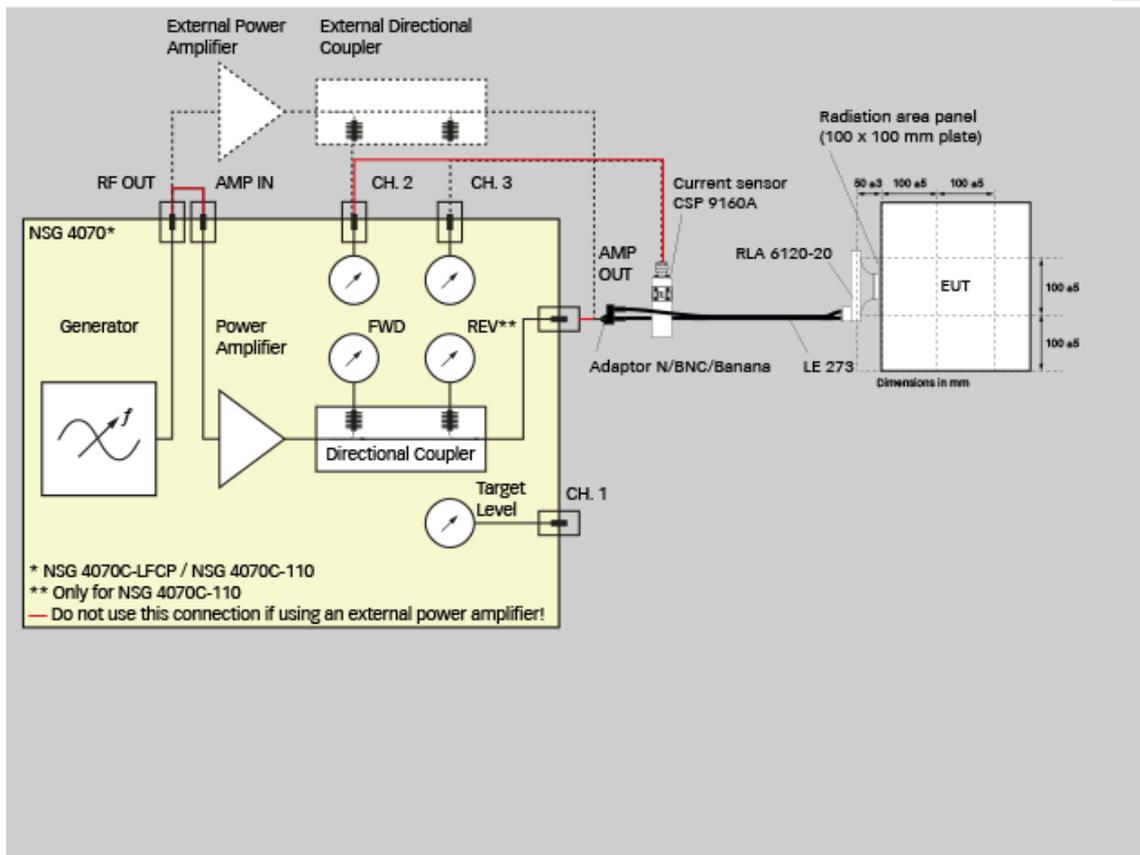
■ A file name must be assigned.

■ Click "Save" to save the calibration.

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



Test Setup for IEC 61000-4-39 (Edition 1) - 9 kHz .. 150 kHz



■ 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.

■ Change the dwell time according to the standard specification.

■ A double click into the diagram opens the following menu for selecting the current probe.

The screenshot displays the ICD.CONTROL software interface. The main window is titled "IEC 61000-4-39 (Edition 1) - LF.nr.". The "Calibration" tab is active, showing the following settings:

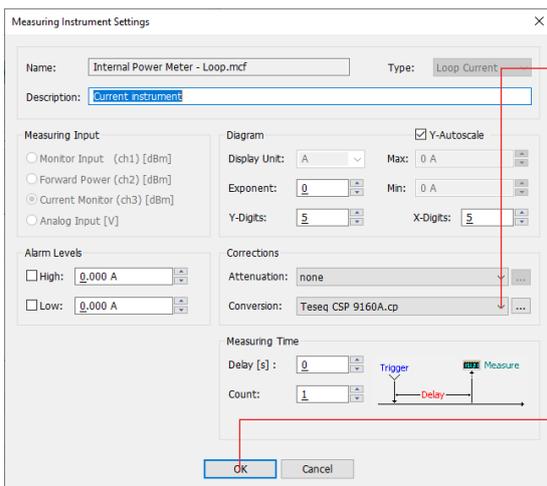
- Standard: IEC 61000-4-39 (Edition 1) - 9 kHz .. 150 kHz
- Frequency: 0.009000 MHz - 0.150000 MHz
- Step: 0.010 MHz
- Dwell Time: 2.0 s
- Use Limiter:
- AM 1kHz 80%

The graph shows a plot of [A/m] vs frequency (10 kHz to 1 MHz) with a horizontal line at Level 3. The "Level" section on the right has Level 3 selected. The "Loop Current" dropdown is set to "Internal".

An inset window titled "Loop Current: Internal Power Meter - Loop" is open, showing a graph of [A] vs frequency (10 kHz to 1 MHz) with a horizontal line at approximately 6.5 A. Below the graph is a list of standards:

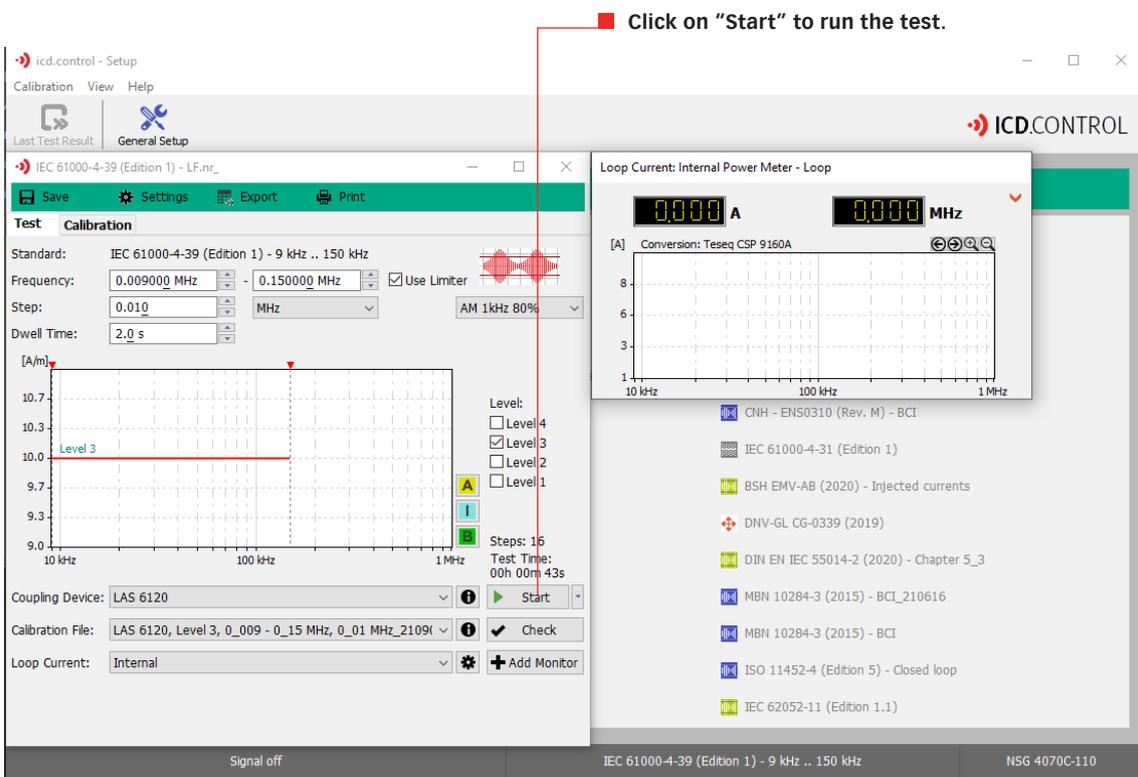
- CNH - ENS0310 (Rev. M) - BCI
- IEC 61000-4-31 (Edition 1)
- BSH EMV-AB (2020) - Injected currents
- DNV-GL CG-0339 (2019)
- DIN EN IEC 55014-2 (2020) - Chapter 5_3
- MBN 10284-3 (2015) - BCI_210616
- MBN 10284-3 (2015) - BCI
- ISO 11452-4 (Edition 5) - Closed loop
- IEC 62052-11 (Edition 1.1)

Red lines connect the text instructions to the "Settings" button, the "Dwell Time" field, and the graph area in the main window, and to the graph area in the inset window.

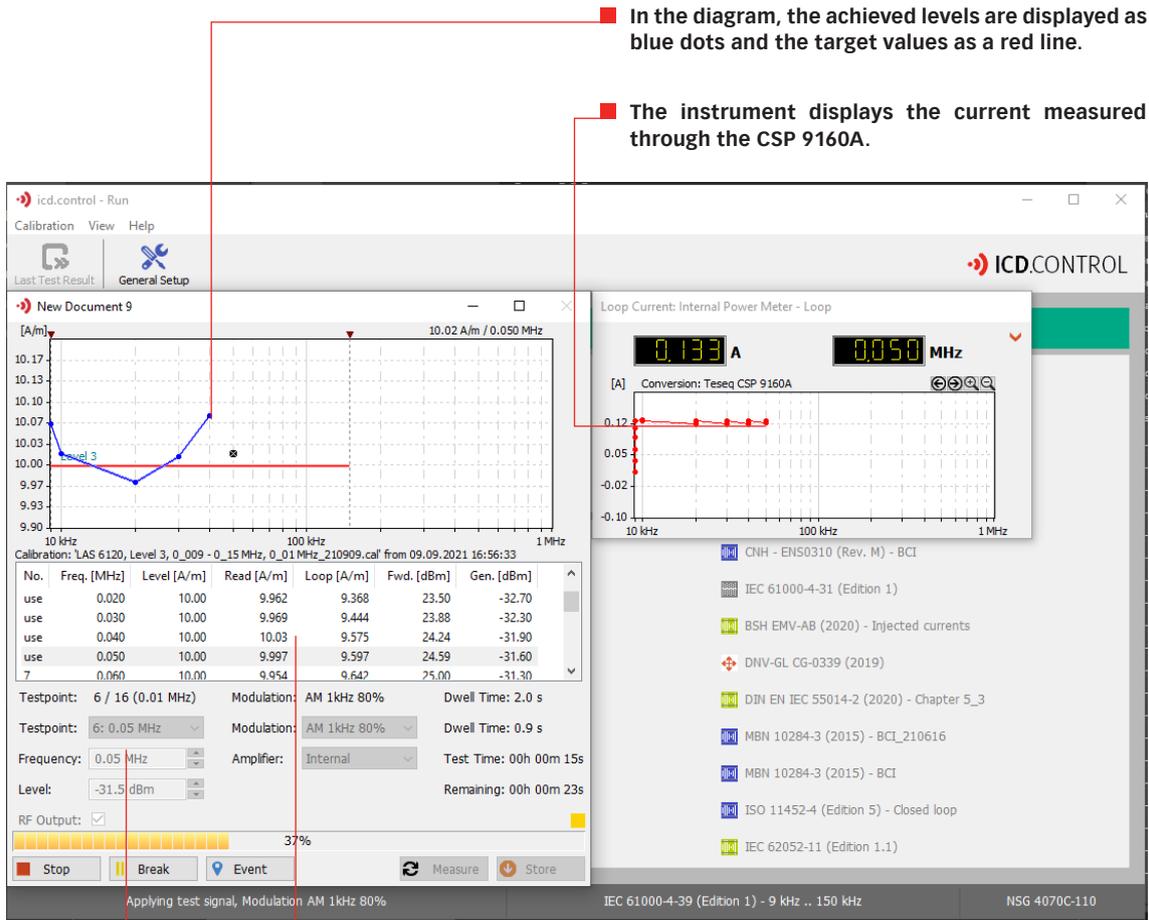


■ Select here the file containing the correction data of the CSP 9160A. Clicking on the icon  opens the file.

■ 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 instrument displays the current measured through the CSP 9160A.

■ 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.

3.5. Test end and report creation

■ 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.

■ Corresponding fields can be filled out and comments inserted.

■ Click on "OK" to apply the settings.

■ Give a proper file name and press "Save".

3.6. Save the configuration

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

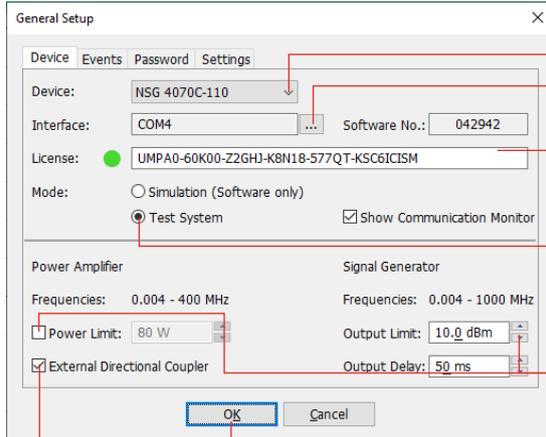


4. EXAMPLE IEC 61000-4-39 HF TEST WITH EXTERNAL DIRECTIONAL COUPLER AND AMPLIFIER

4.1. Basic settings

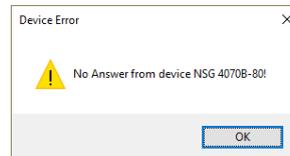


- Clicking on "General Setup" opens the generator settings menu.



- 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.

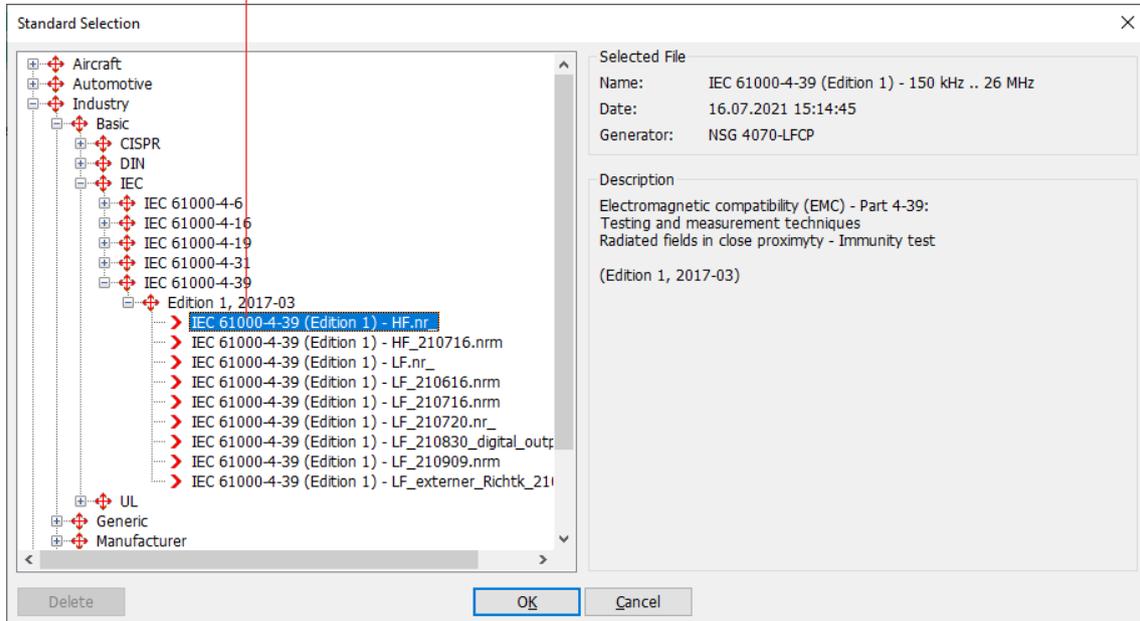
- If the hacking is set, the NSG 4070 expects the forward power at channel 2. For operation with the internal power amplifier and internal directional coupler, the hook must not be set.

4.2. Selecting and loading the test configuration



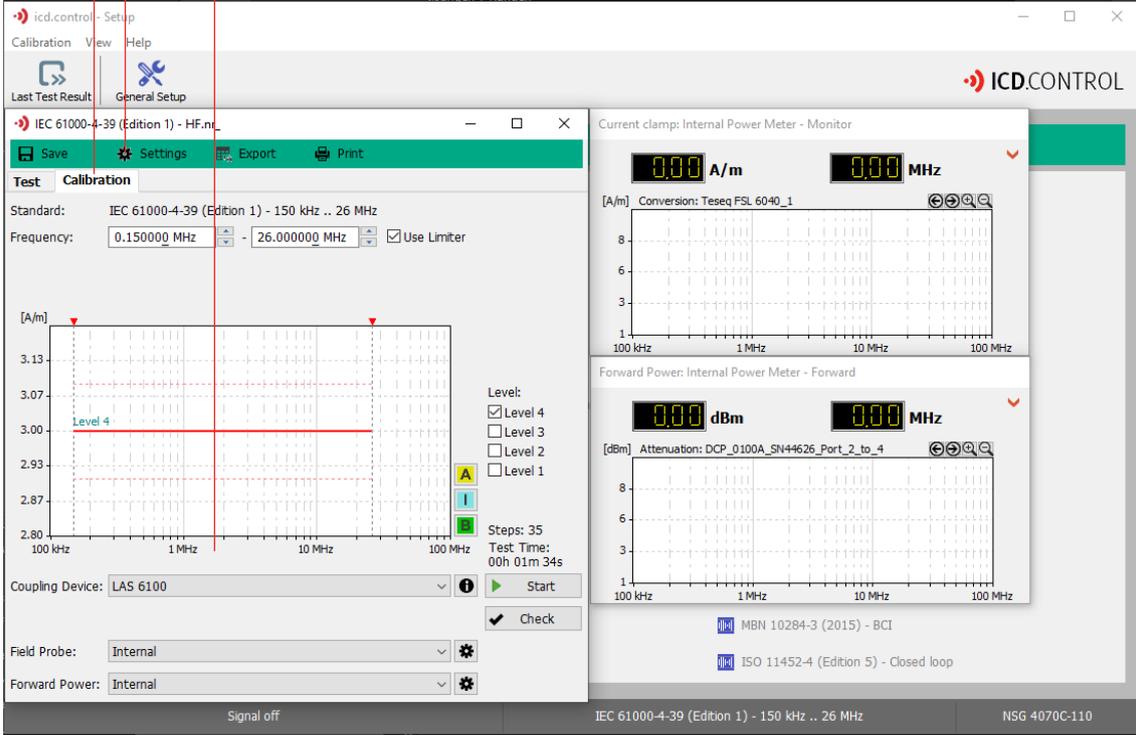
Click here to open the library.

Click here to open the configuration.

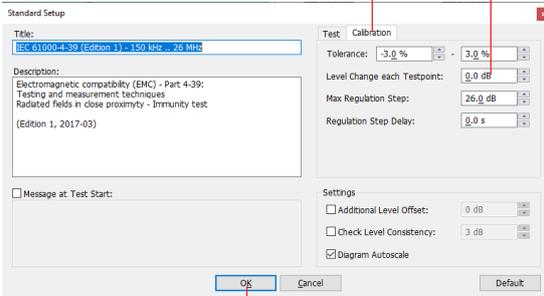


4.3. Calibration (test level adjustment)

- Select "Calibration" to set the test level setting for the connected hardware.
- Select "Setup Standard" to change the basic settings for this test. See the example below.
- Select here the LAS 6100.

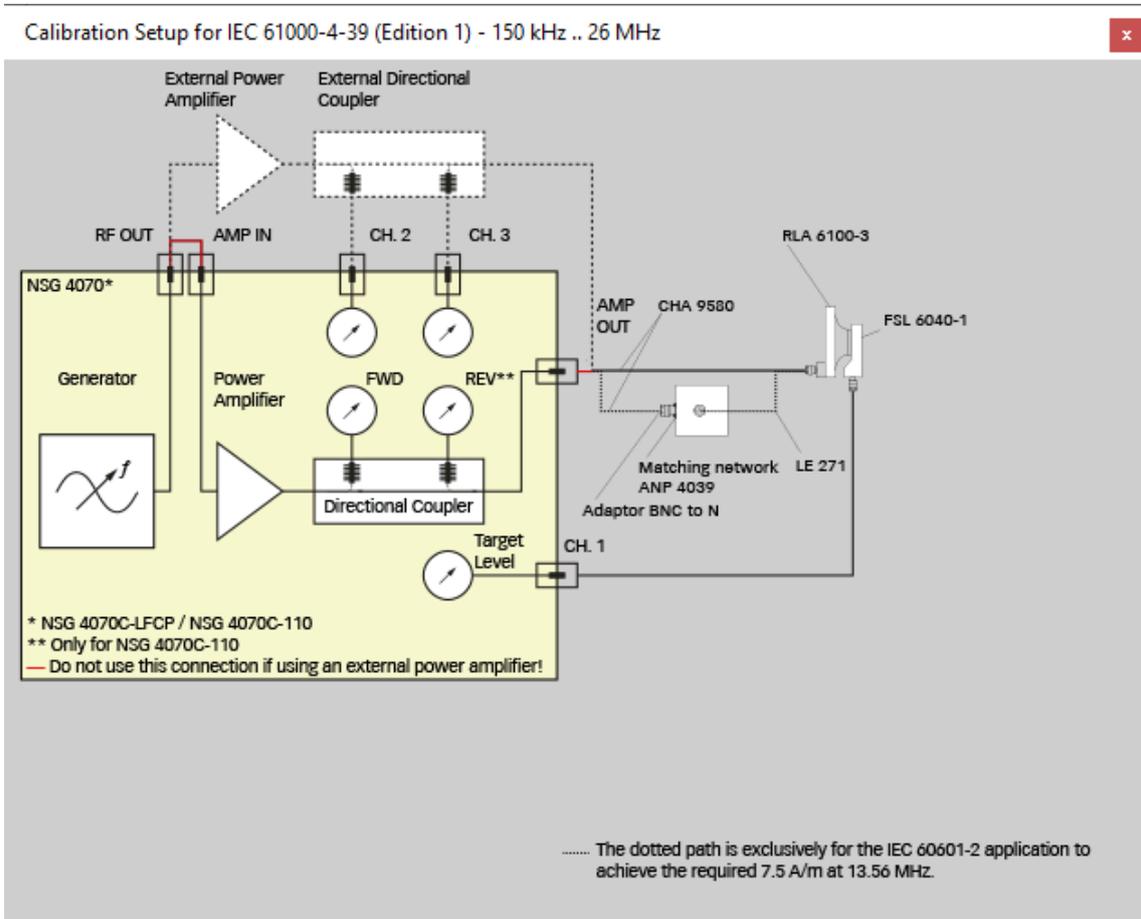


- Choose "Calibration".
- With a value of, for example, -6 dB, the level would be lowered by 6 dB at each frequency step and then gradually increased to the target level. A level reduction may be required by the standard. During calibration (procedure for setting the test level) these requirements do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

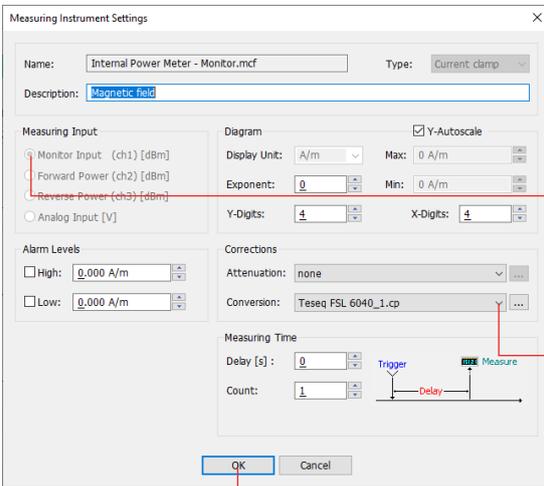
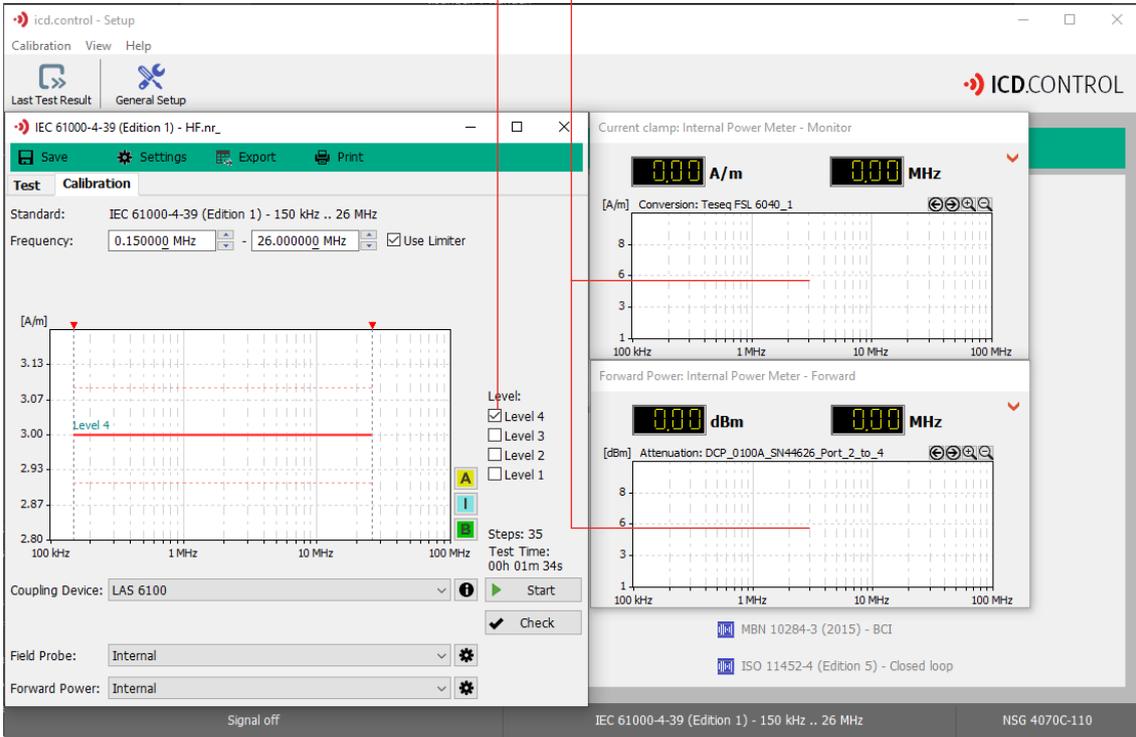


- Click "OK" to save the settings.

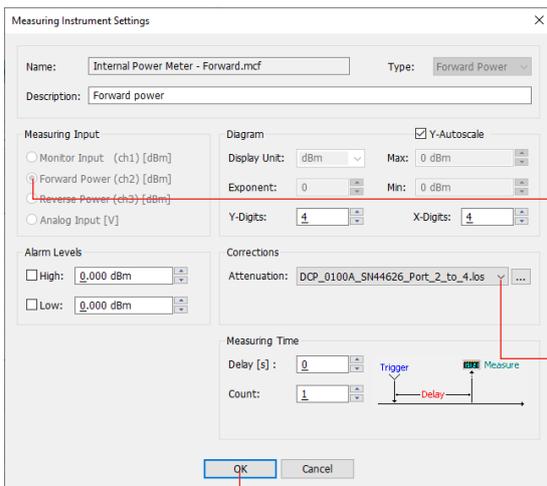
■ Select "View" and "Show Test Setup" to display a sample image for the test setup.



- Set the test level.
- A double-click into the diagram opens the following menus.



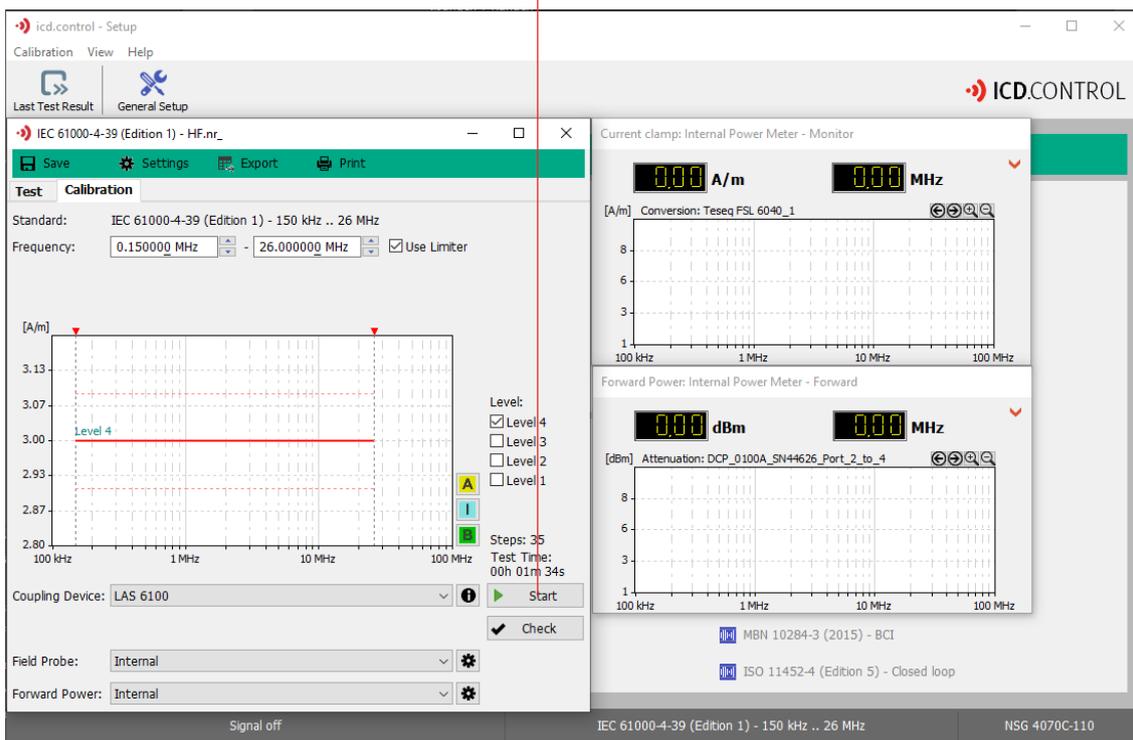
- Please note, this window is valid for power meter channel 1. It means, the sensor loop needs to be connected to power meter channel 1.
- Select here the file which contains the correction data for the loop sensor. Clicking on the icon  opens the file.
- Click "OK" to save the settings.



■ Please note, this window is valid for power meter channel 2. It means, the forward power port of the external directional coupler needs to be connected to power meter channel 2.

■ 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.

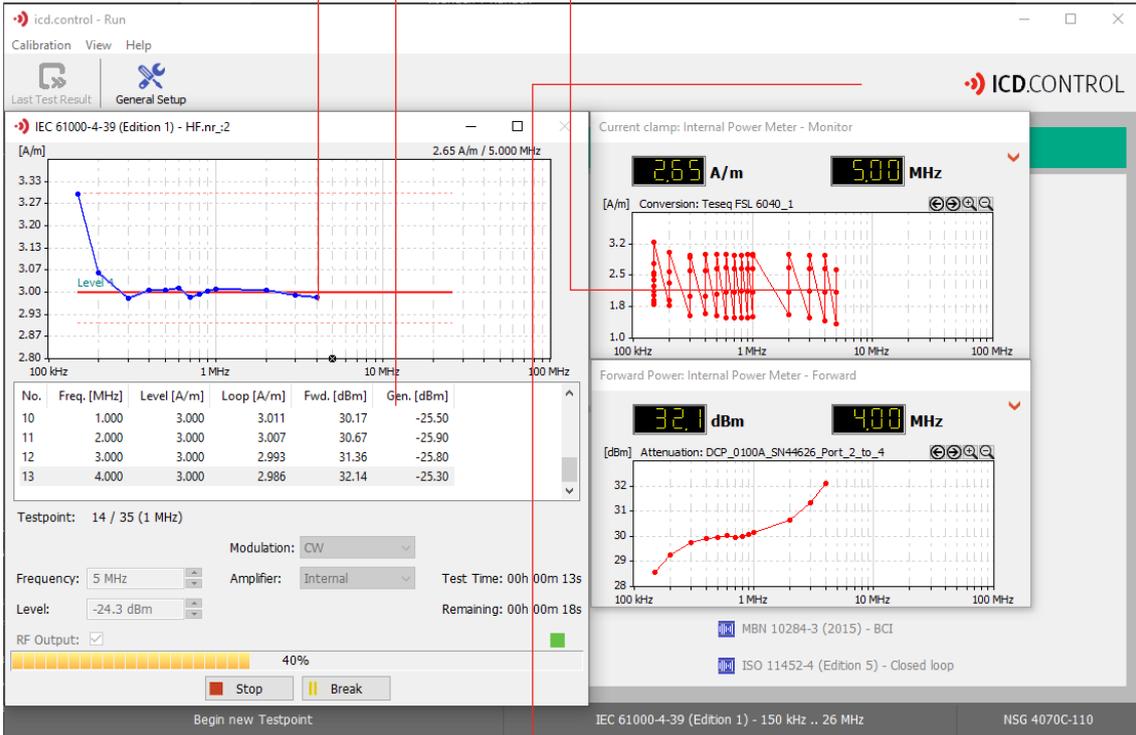


■ Click on "Start" to execute the calibration..

■ 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, read level, loop level, forward power and generator power.

■ The instrument shows the measured magnetic field strength with the loop sensor.



■ The instrument shows the measured forward power.

Calibration Report

Range	Environment
Frequency: 0.15 - 26 MHz	Temperature: 23 °C
Level: Level 4	Humidity: 46 %
	Pressure: 988 mbar
Coupling Device	
Name: LAS 6100	Note:
Range: 0.15 - 30 MHz	Description:
SNo:	

Save Cancel

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

■ A comment can be inserted.

■ Click "Save" to save the settings.

Save calibration

Existing Calibration Files:

- LAS 6100, Level 3, 0.15 - 26 MHz_210716.cal
- LAS 6100, Level 4, 0.15 - 26 MHz_210716.cal
- LAS 6100, Level 4, 0.15 - 26 MHz_210716_2.cal
- LAS 6100, Level 4, 0.15 - 26 MHz_210722.cal
- LAS 6100, Level 4, 0.15 - 26 MHz_210913.cal**
- LAS 6100, Level 4, 0.15 - 26 MHz_fehlerhaft_210716.cal
- LAS 6120, Level 1, 0.009 - 0.15 MHz_0.01 MHz_210629.cal
- LAS 6120, Level 3, 0.009 - 0.15 MHz_0.01 MHz_110_210831.cal
- LAS 6120, Level 3, 0.009 - 0.15 MHz_0.01 MHz_210714.cal
- LAS 6120, Level 3, 0.009 - 0.15 MHz_0.01 MHz_210716.cal
- LAS 6120, Level 3, 0.009 - 0.15 MHz_0.01 MHz_210720.cal
- LAS 6120, Level 3, 0.009 - 0.15 MHz_0.01 MHz_210722.cal
- LAS 6120, Level 3, 0.009 - 0.15 MHz_0.01 MHz_210909.cal

File Name:

LAS 6100, Level 4, 0.15 - 26 MHz_210913

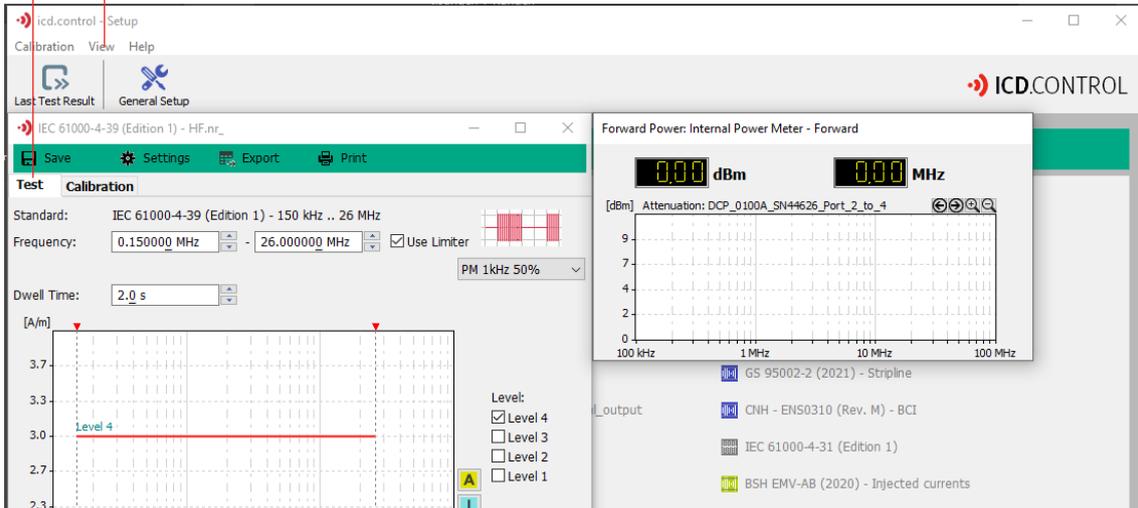
Save Cancel

■ A file name must be assigned.

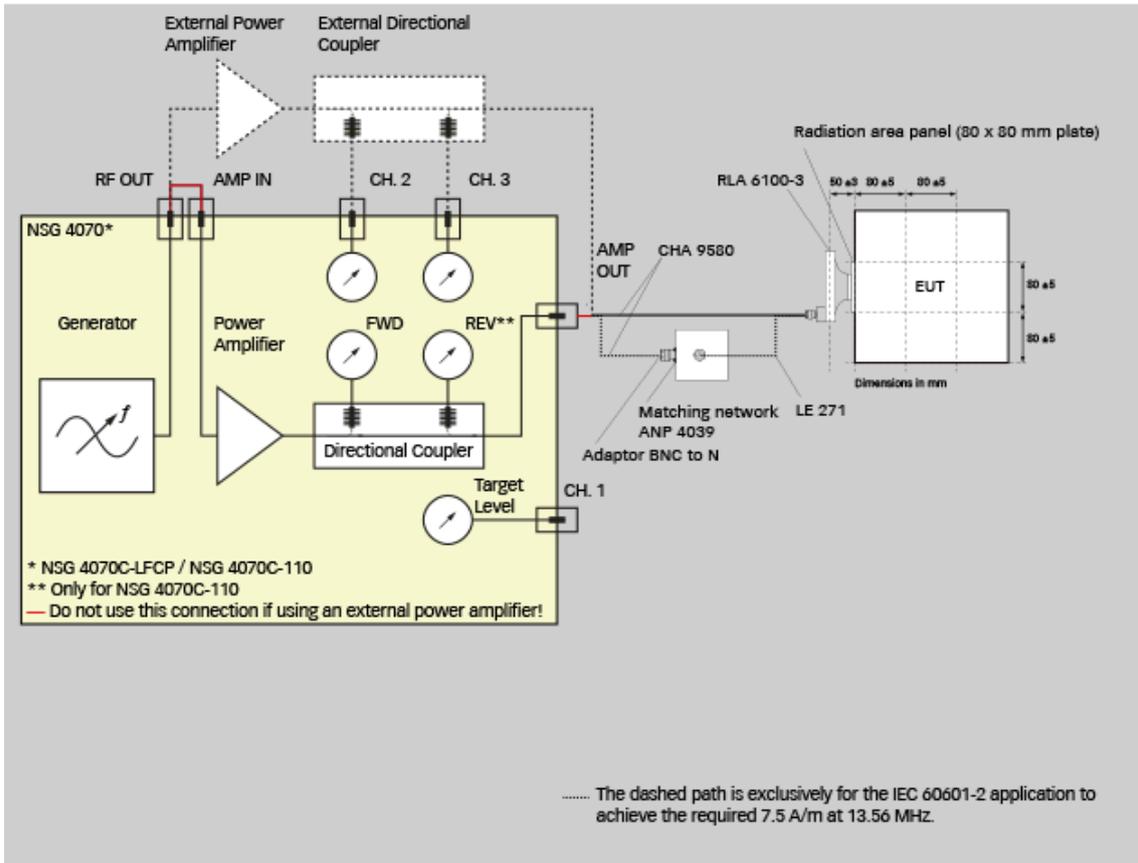
■ Click "Save" to save the calibration.

4.4. Test

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



Test Setup for IEC 61000-4-39 (Edition 1) - 150 kHz .. 26 MHz

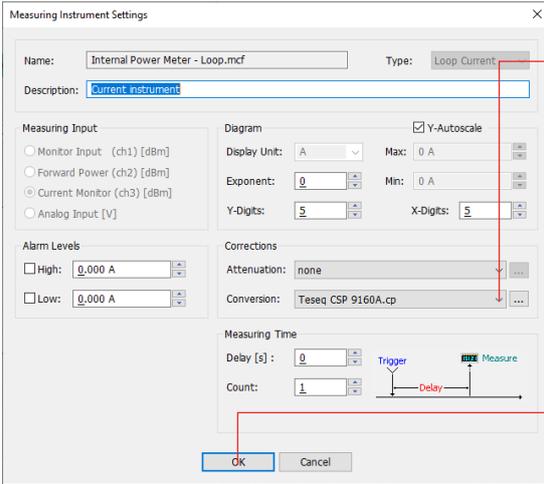


■ Change in "Setup standard" eg. the lowering of the level per frequency step according to the standard specification. Click on the edge of the window if the "Setup Standard" switch is greyed out.

■ Change the dwell time according to the standard specification.

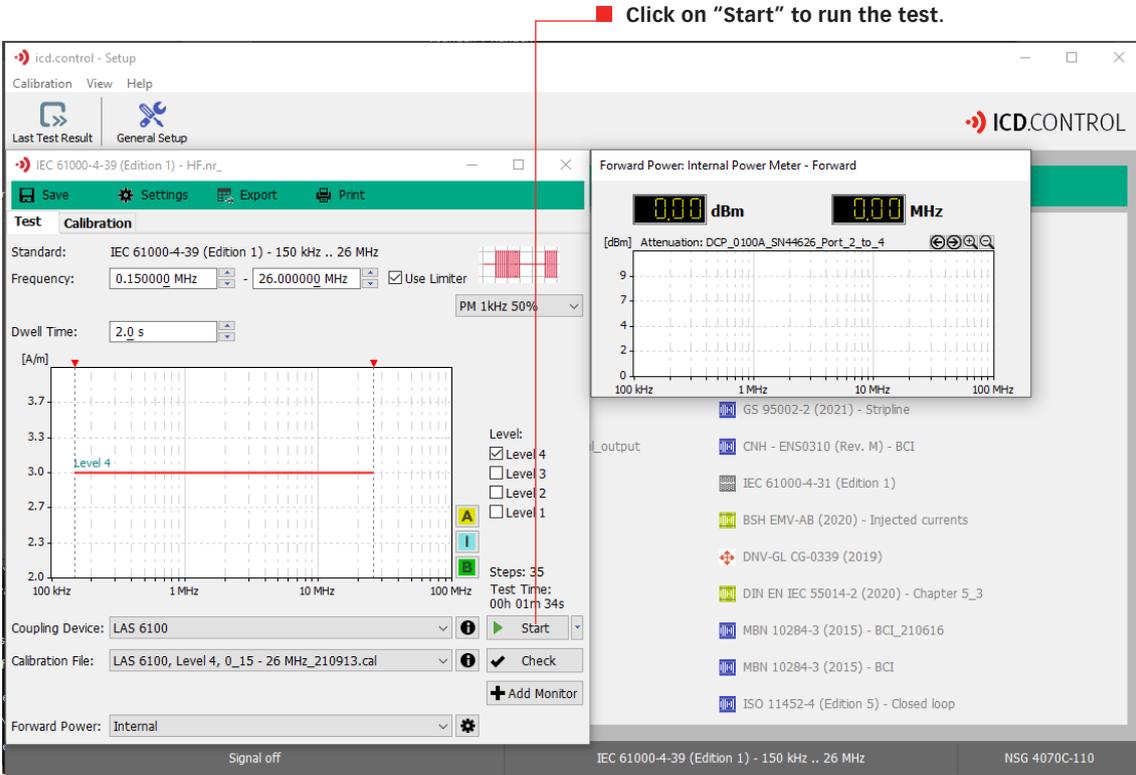
■ A double click into the diagram opens the following menu for selecting the current probe.

The screenshot shows the ICD.CONTROL software interface. The main window is titled "icd.control - Setup" and displays the "Calibration" tab. The test setup is for IEC 61000-4-39 (Edition 1) - 150 kHz .. 26 MHz. The frequency range is set to 0.150000 MHz to 26.000000 MHz. The dwell time is set to 2.0 s. The graph shows a red line at Level 4, which is set to 3.0 A/m. The "Forward Power" window is open, showing a graph of [dBm] vs frequency (100 kHz to 100 MHz) with a red line at 7 dBm. The "Forward Power" window also displays a list of standards, including GS 95002-2 (2021) - Stripline, CNH - ENS0310 (Rev. M) - BCI, IEC 61000-4-31 (Edition 1), BSH EMV-AB (2020) - Injected currents, DNV-GL CG-0339 (2019), DIN EN IEC 55014-2 (2020) - Chapter 5_3, MBN 10284-3 (2015) - BCI, MBN 10284-3 (2015) - BCI, and ISO 11452-4 (Edition 5) - Closed loop.

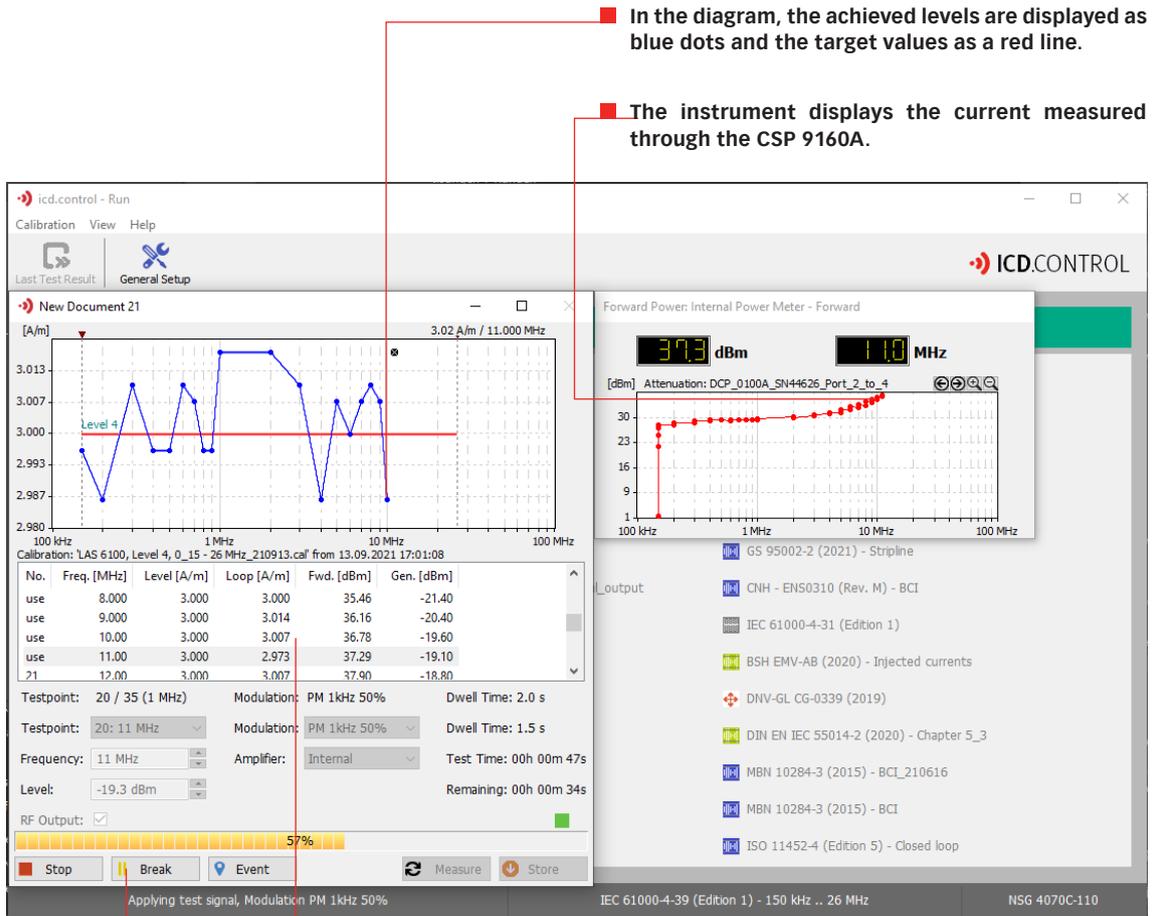


■ Select here the file containing the correction data of the CSP 9160A. Clicking on the icon  opens the file.

■ Click "OK" to save the settings.



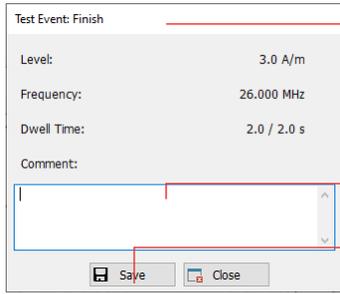
■ Click on "Start" to run the test.



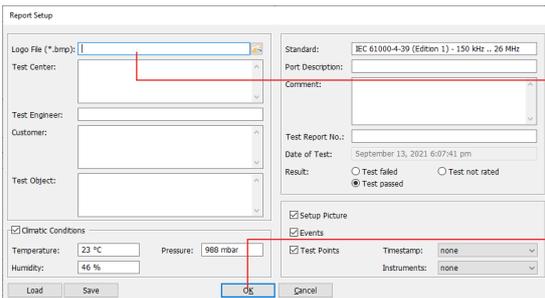
The table shows the currently used values of the calibration file.

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.

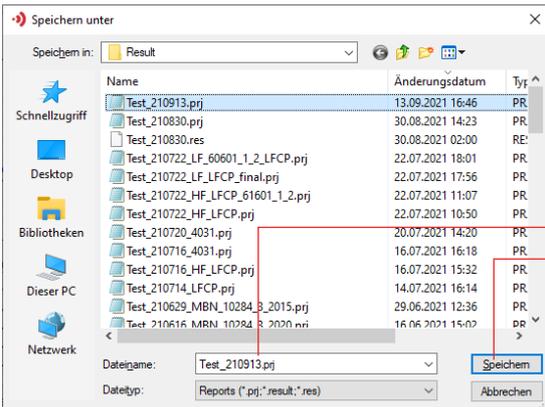
4.5. Test end and report creation



- 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.

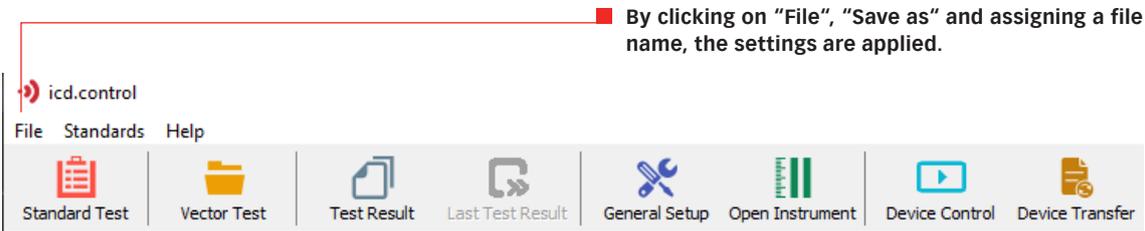


- Corresponding fields can be filled out and comments inserted.
- Click on "OK" to apply the settings.



- A file name must be assigned.
- Click "Save" to save the result.

4.6. Save the configuration



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

Manufacturer**AMETEK CTS Europe GmbH**

12623 Berlin, Germany
 Landsberger Str. 255
 T +49 30 5659 8835
 F +49 30 5659 8834
 sales.cts.eu@ametek.com
www.ametek-cts.com

China**AMETEK Commercial Enterprise (Shanghai) Co., Ltd. Beijing Branch**

T +8610 8526 2111
 F +8610 8526 2141
 sales.cts.cn@ametek.com

Japan**AMETEK Co., Ltd. Nagoya Office**

T +81 52 709 5501
 cts-japan.sales@ametek.com

Taiwan**AMETEK Taiwan Corp. Ltd**

T +886 3 575 0099
 taiwansales.cts@ametek.com

USA**AMETEK CTS US**

T +1 732 417 0501
 Toll free +1 888 417 0501
 usasales.cts@ametek.com

Europe**AMETEK CTS Europe GmbH**

T +49 2307 26070-0
 sales.cts.eu@ametek.com

Singapore**AMETEK Singapore Pte Ltd**

T +65 6484 2388
 singapore.sales.cts@ametek.com

To find your local partner within
 Teseq's global network, please go to
www.ametek-cts.com



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