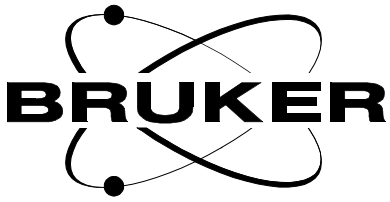

HWT

HardWare Tests
Installation and User Manual

Version 001

BRUKER

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Introduction 1

General Remarks 1.1

This document describes the installation and the setup of the suite of tests known as **H**ard**W**are **T**ests (**HWT**). These tests are based on the tests compiled in the article by Joseph B. Vaughn and Philip L. Koons, Spectroscopy 1995, **10** (1) 36 - 40. All currently available tests are performed on a "doped water sample“ (see section 1.5 for an exact description of the sample). The chief operator of the NMR system should be the one person that performs these tests and procedures. Any one with a sound knowledge of the hardware and software installed should be able to run all tests successfully.

Usage of this Manual 1.2

For all who perform demos, do final testing, installations and service on AVANCE series NMR spectrometers and, in this process, install and use HWT to test the NMR spectroscopy related performance of certain hardware components.

Font conventions 1.3

`bold-Courier`: UNIX commands to be entered from the keyboard

bold-Times: UNIX commands or applications started by mouse click

`bold-Courier-italic`: NMR Suite commands to be entered from the keyboard

bold-Times-italic: NMR Suite commands or applications started by mouse click

`Courier`: File names and directory names

General laboratory requirements 1.4

The temperature stability in your laboratory and the temperature stability of your spectrometer have a significant impact on the quality of the HWT tests. A maximum variation of the room temperature of +/-0.5C is about the highest tolerance you should allow before running these hardware tests. Please get in touch with an applications person if you have further questions regarding the general laboratory requirements.

Recommended sample 1.5

We recommend the new Bruker standard sample of 99% D_2O and 1% H_2O with 0.1 mg/ml $GdCl_3$ for the HWT tests. The tests can also be performed with the old standard sample of 1% H_2O/99% D_2O with 2mMole copper sulfate.

Table 1.1.

Description	Part number	Appr. T1
NMR-Sample 0,1mg $GdCl_3$ 2.5 mm	Z10087	200 msec
NMR-Sample 0,1mg $GdCl_3$ 5 mm	Z10088	200 msec
NMR-Sample 0,1mg $GdCl_3$ 8 mm	Z10089	200 msec
NMR-Sample 0,1mg $GdCl_3$ 10 mm	Z10090	200 msec
NMR-Sample 2mM $CuSO_4$ 2.5 mm	Z10295	800 msec
NMR-Sample 2mM $CuSO_4$ 5 mm	Z10280	800 msec
NMR-Sample 2mM $CuSO_4$ 8 mm	Z10283	800 msec
NMR-Sample 2mM $CuSO_4$ 10 mm	Z10281	800 msec

Duration of the tests 1.6

The duration of the tests naturally depends on some spectrometer properties, which are difficult to generalize. From our experience, running all currently available tests in one setup will take about 2.5 hours. The first time the HWT suite is ran on a particular system, each of the Au programs must be compiled, this will add approximately 30 minutes. The relaxation delay of your sample is the parameter that will have the biggest contribution to the overall duration of the tests.

At the beginning of any HWT test sequence, an automatic T1 determination of your sample will be started. This T1 determination expects the T1 to be not longer than 5 seconds. The program will display the estimated T1 value and the resulting D1 value and will ask you whether this value is acceptable or not. If you want to work with a different value than the one determined by the program then you do this at your own risk and the results will not be comparable with those obtained under correct conditions. See also chapter 4.2 for more details.

Installation procedure 2

Download 2.1

All files required for HWT are distributed as a "gzipped" tar file. The latest version is always available from the FTP-server at Bruker Analytik GmbH in Karlsruhe, Germany. This server can be accessed as **ftp.bruker.de**.The HWT file is located in the restricted access section `/private/nmr`. This is the sequence of commands to get the HWT package:

- **`ftp ftp.bruker.de`**

login as user ftp and give your email address as password

- **`quote site group nmr`**
- **`quote site gpass XXXX`**

where **XXXX** stands for a password, which can be obtained on request from one of the authors

- **`bin`**
- **`hash`**
- **`cd /private/nmr`**
- **`get hwt_forX.Y.tar.gz`**

where **`X.Y`** stands for the version of the HWT package

You should always get the version that matches with your current XWIN-NMR version. Version 2.x works for XWIN-NMR2.0 and 2.1. Downloading this file is currently only possible for Bruker personnel.

Installation 2.2

First, you must "gunzip" the downloaded file.

- **`gunzip hwt_forX.Y.tar.gz`**

This results in a file called `hwt_forX.Y.tar`. Should you get the error message "gunzip: Command not found", then either you do not have this utility installed on your computer or the path to this program is not known to the system. Make sure that the gzip software package is correctly installed and that the pathname to the directory where gzip resides is part of your PATH environment variable. If gzip is not installed on your system, then you must get it from the American or German FTP server. The gzip package is located on the German FTP server in `/pub/nmr/binaries.sgi` for SGI computers.

After you have successfully "unzipped" the .gz file, the tar archive `hwt_forX.Y.tar` is ready to be extracted. All files in the archive are relatively addressed. Thus, it is important to start the extraction from the correct directory. For standard installations of XWIN-NMR2.0 (and newer) this is `/u`. For custom in-

stallations of XWIN-NMR2.0 (and newer) this is the directory into which XWIN-NMR was installed. It is most likely the directory that is also defined by the environment variable **XWINNMRHOME**. The sequence of commands for the correct extraction is as follows.

- **echo $XWINNMRHOME**
- **su or su - <nmr superuser>**

  (where nmr superuser is the login name which has been selected during the XWIN-NMR installation.)

- **cd /u**

  (**$XWINNMRHOME** respectively)

- **tar xvf <path to tarfile>/hwt_forX.Y.tar**

All necessary Tcl/Tk scripts, pulse programs, AU programs and parameter sets are now installed on your system.

Post-installation procedures *2.3*

Before you can start to use the tests, the following standard procedures have to be executed.

- Your spectrometer must be properly configured and the basic configuration commands must have been executed. This includes commands such as ***cf***, ***edhead***, ***edlock*** etc. Make sure that your hardware list file contains all entries that describe your current hardware equipment.
- Check the gasflow.
- The temperature unit should have been self-tuned for the desired temperature. You would usually run the tests at approximately 300 K.
- Optimize your lock parameters for the sample that you use.
- ***expinstall***

  You should enable the following items from the selection window.

  Install Bruker Library AU Programs/Modules

  Convert Standard Parameter Sets

  After the extraction of the tar archive, several new AU programs and modules will have been installed. expinstall will compile them and will make them available for XWIN-NMR. There are also some basic parameter sets which are needed for the HWT tests which are installed in this step. You can disable all other items from the expinstall selection menu, but enabling them will not cause a problem, either.

- ***cortab*** or ***qtp***

  For acceptable results in several tests like amplitude linearity, modulator linearity, shape pulse excitation profile and the dante pulse linearity test it is essential that the amplitude and phase lookup tables be in place. Please see the cortab/qtp manual for further details.

- adjustment of the XWIN-PLOT layout `t1norm.xwp` in `/u/plot/layouts`

  This layout is used for plotting of all results that were generated with the simfit routine. Several tests are analyzed with statistical methods and the

results are plotted through XWIN-PLOT. The default layout file is optimized for European A4 and American A size paper and generates postscript plotter code. Nevertheless, you should adjust these two parameters according to the paper size and the type of the plotter you are currently using in XWIN-NMR. It might also be necessary to modify the print command in the ***options printer setup*** menu to the settings appropriate for your system. Next, you can modify font sizes etc. at your leisure. Using the ***file save*** function then stores the changes back to this layout file. Usually, a change of permissions on this file is required. Become superuser, change to the `/u/plot/layouts` directory and do a **`chown`**, **`chgrp`** and **`chmod`** on the file `t1norm.xwp` according to your system setup.

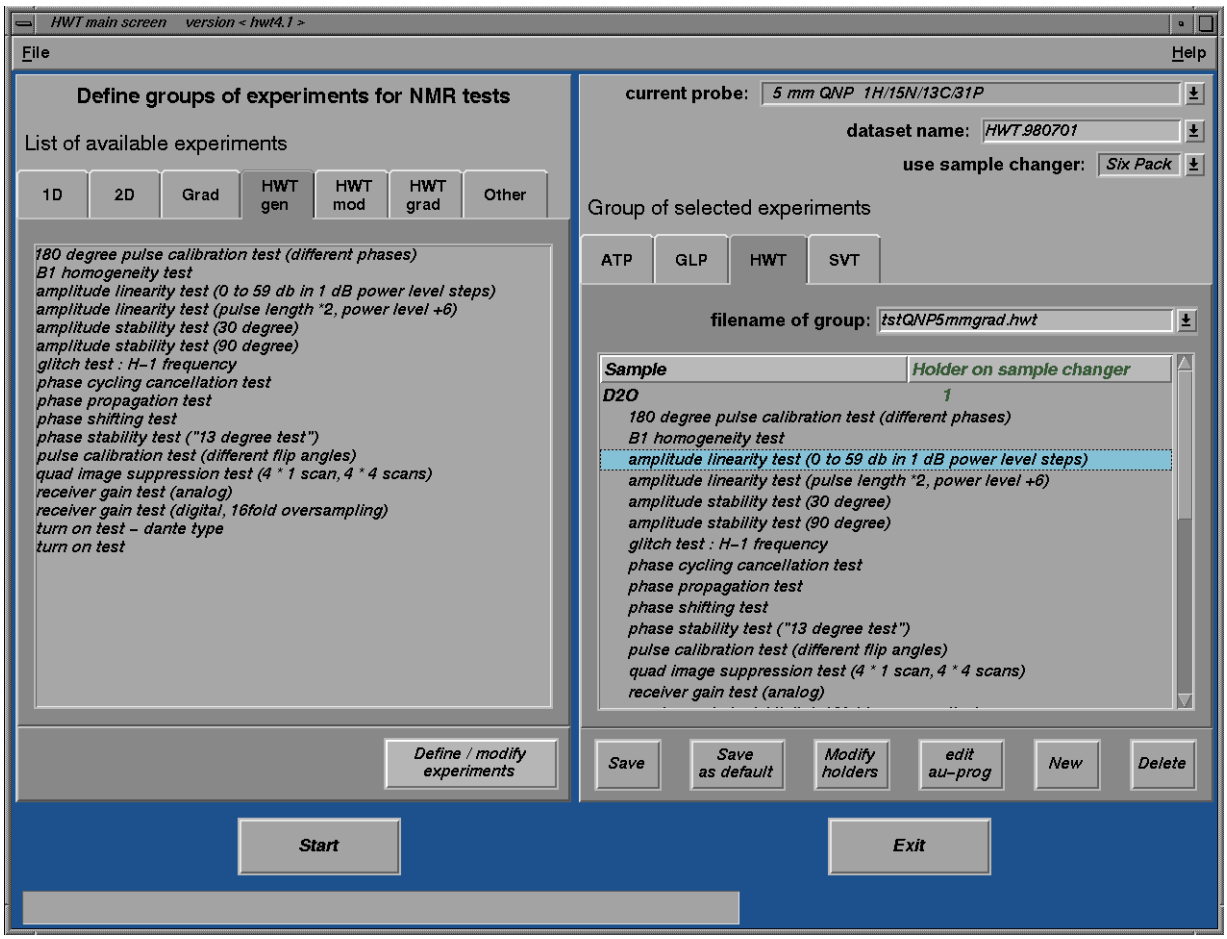
Define and start tests - the command hwt

3

Set up a sequence of HWT tests 3.1

The command ***hwt*** starts an interface (shown below) which allows you to define and start a HWT, GLP or SVT test sequence. GLP and SVT tests are described in a separate GLP and SVT manual (Part number H9532). This manual covers only the HWT tests.

Figure 3.1. The HWT "Define groups of experiments" window



The left-hand side of the window shows all available tests. They are divided into several groups. For the HWT suite, the tests under **HWTgen**, **HWTmod** and **HWTgrad** are important. **HWTgen** tests are the general hardware tests. **HWT-**

mod are the tests that are used to test the shaped pulse hardware (which are the ASU or ASU/LOT boards). **HWTgrad** are the gradient hardware tests.

The modulator tests and gradient tests are only applicable if your instrument is equipped with the necessary hardware. The HWTmod (modulator) tests are only applicable for double bay cabinets OR systems equipped with an ASU/LOT board. The HWTgen tests are applicable for all Avance systems. The HWTgrad tests will only be meaningful for a system equipped with gradient hardware and probes. The gradient tests can be performed with either single or triple axis gradient hardware.

A test is selected for execution by clicking on its description line. Keeping the left mouse button depressed while moving it up or down selects several tests. Releasing the mouse button will immediately copy the experiment(s) from the left-hand side of the HWT window to the right-hand side of the HWT window (see below). The tests listed on the right-hand side of the window will be performed in the order in which they are listed.

The top right-hand side of the HWT window shows some important parameter settings.

- ***current probe***

  This entry shows the current probe as defined with the XWIN-NMR command ***edhead***. You can change the current probe by clicking on the arrow. Changing the probe in this window is equivalent to changing the probe with edhead. Caution; only change the probe head to the actual probe head installed in the system.

- ***dataset name***

  The name in XWIN-NMR under which all tests will be stored. You can select any already existing dataset or you can leave this field empty. If this field is left empty, the software will create a default dataset name. This default name is always HWT.<currentdate>. The software will check for already existing experiments ("EXPNO's") in the selected dataset. A new run will always start on the next higher unused EXPNO of the selected dataset.

- ***use sample changer***

  You can choose whether the tests should be performed with or without a sample changer. If a sample changer is selected, then all tests on one sample will be automatically associated with a holder position upon selection. We currently support the BACS60(r), BACS120(r) and Sixpack(r) sample changers. If no sample changer is selected, then you will be prompted to manually exchange samples if tests have been selected which require more than one sample.

The bottom right part shows the sequence of selected experiments. They are stored in so-called "**group**" files. Select the ***HWT*** button before you store a list of tests to a "**group**" file. ATP (Acceptance Test Procedure) tests are started with the atp program. GLP and SVT tests should be started with the glp program. The HWT distribution comes with two predefined "**group**" files, which can be loaded by clicking on the button to the right of the ***filename of group*** window. You can read such a predefined sequence, modify it and then store it under the same or a new name.

The buttons at the bottom of the screen have the following functions:

- ***Save***

Save the selected experiments to the "**group**" file specified in the "**filename of group**" field.

- ***Save as default***

  Save the selected "group" file as the default "group" file. The next time you start HWT, the interface will start with the selections you have just stored as default.

- ***Modify holders***

  If you have selected a sample changer, then you can reassign the holder positions of the samples with this function. A little window as shown below is opened.

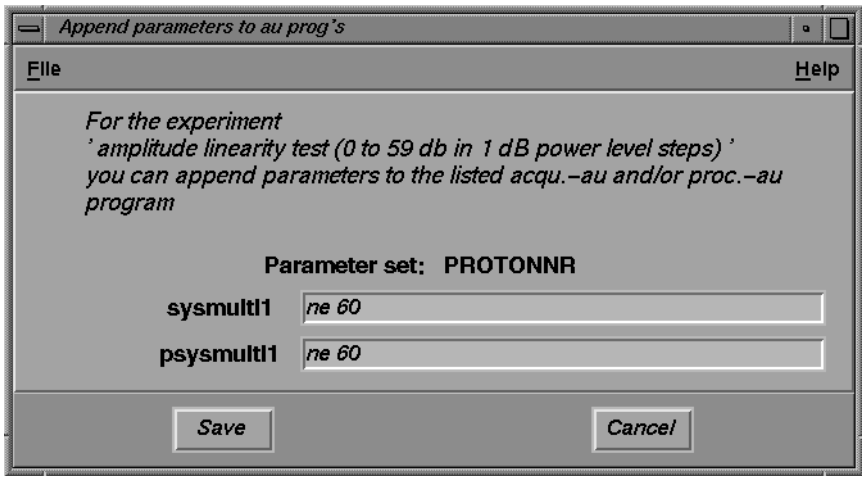
Figure 3.2. The "Modify holder" window

You can type in new holder positions or scroll the numbers up and down using the arrow keys. The button ***Increment automatically*** arranges all samples so far selected into subsequent holder positions. Note that in the case of the HWT tests usually only one sample will be present in the list, because all experiments are performed on the same sample.

- ***Edit au-prog***

  Several tests can be started with variable parameters (see chapter 4.4 to 4.6 for more details). First, you must select an experiment in the right-hand side window of the main HWT screen. Just click on the test you want to select. Then you can edit (and modify) the AU program parameters. A little window as shown below is opened. Make sure that parameter values, like the number of experiments, are the same for the acquisition and processing AU program. Please note that these changes will be stored in the "**group**" file, but that they have no effect on the general definition of the test.

Figure 3.3. The"Edit au-prog" window



- ***New***

  This button will clear all selections made in the right-hand side window of the HWT screen and will allow the definition of more tests for a new "**group**."

- ***Delete***

  The delete button will delete all highlighted experiments in the right-hand side window of the HWT screen. You can select several tests by keeping the left mouse button depressed while moving over the tests.

Once you have prepared a "**group**" file, you can start an HWT run by clicking the Start button. Unsaved "**group**" files will be saved automatically to the name selected in the "**filename of group**" line. The Exit button will exit from the HWT program to XWIN-NMR.

You can change certain test properties with the ***Define/modify experiments*** button. See chapter 3.2 and 3.3 for more details.

Edit an existing test *3.2*

The ***Define/modify experiments*** button in the lower right corner of the left side of the main HWT screen allows you edit and change an existing test. The window in which you can change the properties of a test is shown below.

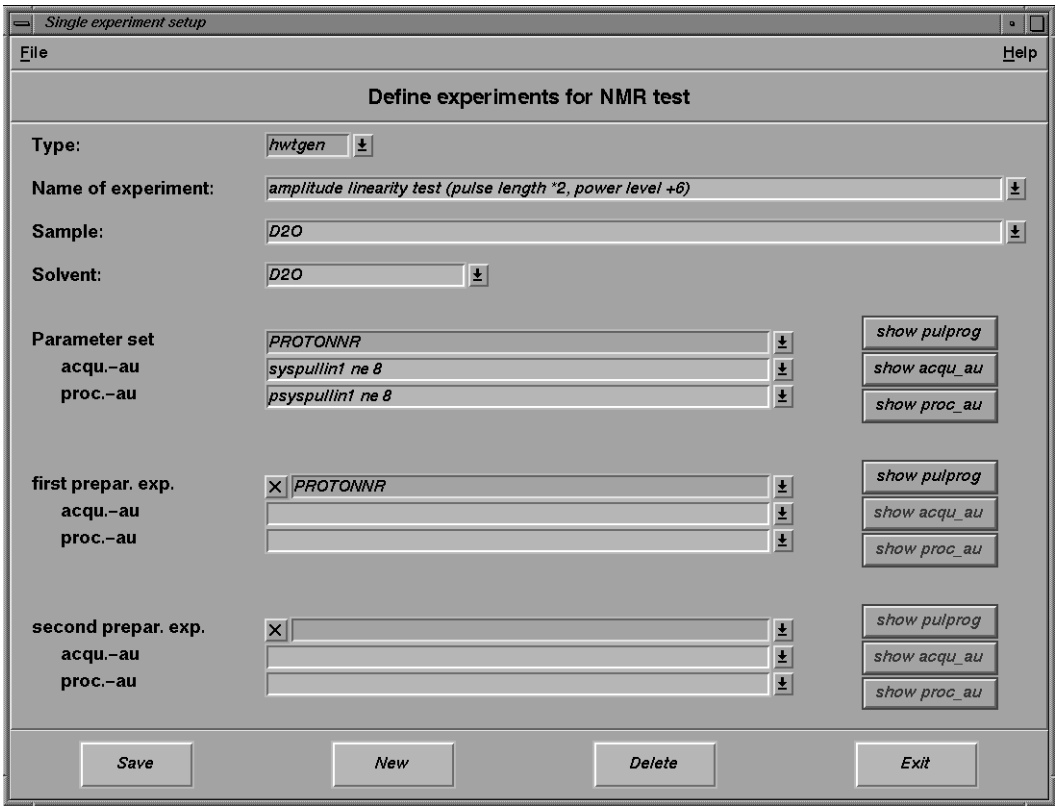
First, select the test category ***Type*** from which you want to edit or change a test.

Next, select a test from the list of already defined tests (***Name of experiment***). This step will fill in all other fields that describe the parameters and properties of a test. You can change these properties by clicking in the corresponding fields and/or selection boxes.

When you click on one of the ***show*** buttons, either the pulse program or the AU program is shown in a separate window. You can use this feature to check the type and number of arguments passed on into the AU program. If you change the number of arguments of an AU program used by a test, then you must make sure that the AU program actually takes the argument(s) and evaluates its (their) value(s) properly. In order for this to work, you might have to modify the AU program. In such a case, you should also look up other tests, which use the same AU pro-

gram. Maybe some or all of these other tests need to be adjusted for the new argument(s).

Figure 3.4. The „Define/modify experiments“ window



If you delete all arguments from the command line of the AU program, then there are two possibilities of what will happen inside the AU program.

1. Default values for all parameters that are required in the AU program will be set and used. This is the predominant handling in the case of the HWT (HardWare) tests.
2. No parameters are set or used. In this case, the parameter set associated with this test must be defined in such a way that all necessary parameters are already defined. This is the predominant handling in the case of GLP and SVT tests.

It is possible to select a new or different parameter set for an experiment. Please make sure that all necessary parameters for the experiment are set. In some cases it might even be advisable to delete arguments from the AU program command line (see above).

Do not change the name (description text) of a test. This will create a new test (see below) rather than modify the existing test!

Important note:

If you change the properties of a test, then the new properties will only become effective in new "group" files. In other words, old (already existing) "group" files will not be effected by your changes. If you want to make the changes effective in old "group" files, then you should read these "group" files and delete the (now modi-

fied) test from the list on the right-hand side of the HWT screen. Then add the test again by clicking on it in the window on the left hand side of the main HWT screen.

Add a new test *3.3*

The ***Define/modify experiments*** button in the lower right corner of the left side of the main HWT screen also allows you to create a new test. The window that comes up is the same as the one shown in chapter 3.2

First, select the test category **Type** in which you want to add a test.

Next, like for editing a test, select an existing test from the list of already defined tests (***Name of experiment***). This will fill in all fields so far defined and used for this test. Now modify the name (description) of the test and make all other changes you want to apply. Saving the changes will add this test to the list of tests in the main HWT window. Obviously, if you use new AU programs or parameter sets, these must have been defined before choosing them in the HWT window.

Selecting a new sample name implies that the test will be executed on its own new holder if a sample changer is used. Without sample changer, the run will prompt you for a sample exchange. In other words, experiments that are run under the same sample name are always kept together on one holder.

Short description of all tests

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Start up dialogue 4.1

After you have defined and stored a series of tests in a "**group**" file, you can start the run with the ***Start*** button in the HWT program. The HWT run will now prompt you for the following information.

- Pulse width of 90 degree ^{1}H pulse
- Power level for the 90 degree ^{1}H pulse
- line broadening factor for the window multiplication

It is important that you optimize the pulse width **P1** and power level **PL1** before starting an HWT run. We recommend an accuracy of +/- 0.2 usec for the pulse width with a length larger than 8 usec. Adjust the power level in order to meet this condition. It is also important that you optimize the pulse width on the doped water sample. The **P1** you will use for the HWT tests will most likely differ from your "normal" pulse width for the 90° pulse measured on a standard Ethylbenzene sample.

It is equally important that you tune and match the probe on the doped water sample.

Remember that all tests are performed non-spinning.

After you have entered the necessary values, a printout will be generated, which lists the experiments by acquisition AU program and experiment number of the data. This same information is also written to a log file, to which experiment specific information will be appended during the HWT run. The complete file is stored in your home directory under the name `hwt.<currentdate>.<No.>` where the No. will be incremented if you start another HWT sequence on the same day. This is an example printout of a log file created upon the start of an HWT run.

Example printout of a log file *4.2*

```
================================================================================

Loop over all experiments for HWT Suite with XWIN-NMR2.1 patchlevel 2

Started on Tue Apr  7 17:30:55 1998

Using experiment file /z/212/prog/tcl/libtix/ntplib/Groups/tstQNP5mmgrad.hwt

Experiments for sample 'D2O' on holder '1' (NAME : HWT.980407)

No.  Name of Exp.                          acqu. AU                         EXPNO
--------------------------------------------------------------------------------

  1  Prep. Exp. for : 180 degree pulse calibration                            1
  2  180 degree pulse calibration test (different   sys180f1t1               2
  3  B1 homogeneity test                            sysb1hom                  3
  4  amplitude linearity test (0 to 59 db in 1 dB   sysmultl1 ne 60           4
  5  amplitude linearity test (pulse length *2, po  syspullin1 ne 8           5
  6  amplitude stability test (30 degree)           sysamp1st factor 0.33     6
  7  amplitude stability test (90 degree)           sysamp1st factor 1.0      7
  8  glitch test : H-1 frequency                    sysglitch                 8
  9  phase cycling cancellation test                syscancel                 9
 10  phase propagation test                         sysphasf1 pulsepr sys    10
 11  phase shifting test                            sysphasf1 pulsepr sys    11
 12  phase stability test ("13 degree test")        sysphas1st ne 32         12
 13  pulse calibration test (different flip angles  sys180f1t2               13
 14  quad image suppression test (4 * 1 scan, 4 *   sysquadim                14
 15  receiver gain test (analog)                    sysrgtest aqmod 1 dig    15
 16  receiver gain test (digital, 16fold oversampl  sysrgtest                16
 17  turn on test - dante type                      sysdante1                17
 18  turn on test                                   systurnon p1start 0.0    18
 19  excitation profile 1                           sysexpro1 p11 6000.0     19
 20  excitation profile 2                           sysexpro1 p11 16.0 sh    20
 21  modulator linearity test (5 - 100% in 5% step  sysmodl1                 21
 22  shaped pulse amplitude linearity test (pulse   syssplin1 p11 16.0 sh    22
 23  shaped pulse amplitude stability test          sysamp1sp9 p11 16.0 s    23
 24  shaped pulse comparison (rectangular, gaussia  syssoftp1 p11 16.0       24
 25  shaped pulse modulator linearity test          sysmodls1 p11 16.0       25
 26  shaped pulse phase stability test              sysphas1sp p11 16.0 s    26
 27  amplitude stability test after gradient echo   sysgrecho p16 5000.0     27
 28  amplitude stability test after gradient echo   sysgrecho p16 5000.0     28
 29  amplitude stability test after gradient pulse  sysgrstab ne 32          29
 30  gradient recovery test                         sysgrreco1 p16 5000.0    30
 31  phase cycling cancellation test after gradien  sysgrcan                 31
 32  z-gradient profile (negative)                  sysgrzpro gradcnst 50    32
 33  z-gradient profile (positive)                  sysgrzpro gradcnst 50    33


Total number of experiments : 33

Sample changer will be used !
```

Experiments automatically performed at program start *4.3*

Directly after starting an HWT run, the following tests are performed automatically. First, a **1D spectrum** is acquired. Its purpose is the determination of the frequency of the HDO resonance, since most subsequent tests are performed with O1 set to this frequency. Exceptions are the 13 degree test that has to be performed exactly 37 Hz off resonance and the shaped pulse excitation profiles, which will be performed at a variety of offsets. The second experiment, performed on the first experiment number, is an **inversion recovery T1 experiment**. The determination of the relaxation time of the sample is important in defining the optimal relaxation delay for all experiments. This delay will be automatically set to **five times** the T1 value found in this test. You will be asked to accept this value or to select a different value. Changing the suggested value can significantly change the quality of the results and is done on your own risk.

Usually, these two experiments will be done on EXPNO 1 because they are done before the actual selected "real" tests. If you start another HWT run on the same day, then this run will check whether EXPNO 1 contains a ser file which is not older than 25 hours. If this is the case, the T1 determination will not be performed automatically. Instead, you will be asked if you want to run with the previously determined T1 value. If you accept the value, the T1 determination will be skipped. If you reject the value, the T1 experiment will be performed again. If you delete EXPNO 1, this check fails and the T1 determination is also automatically done. The automatic O1 determination is always done.

HWTgen tests *4.4*

- **180 degree test** - demonstrates phase settling speed, five repetitions of a 180 degree pulse executed at different phase angles are performed.
- **RF Homogeneity test** - demonstrates the homogeneity of the rf field generated in the observe coil. 100 experiments with incremented pulse length from p1/10 to 10*p1 microseconds are performed. This test is used to determine the 810/90 degree pulse width ratio.
- **Amplitude linearity test 1** - demonstrates the amplitude and phase linearity of the transmitter system. Attenuation is varied from 0 to 59 dB in 1 dB steps. The results are presented as a spectrum and as a semi log plot of intensities with a regression line.
- **Amplitude linearity test 2** - demonstrates amplitude and phase linearity by running a series of experiments where the pulse length is doubled and the attenuation is changed by 6dB from experiment to experiment.
- **Amplitude stability test** - demonstrates the overall amplitude stability of the system. The results of 32 experiments are presented as a spectrum and as table of intensities with statistical analysis. This test can be performed with different pulse width, generally a pulse width of 30 and 90 degrees is used.
- **Glitch test** - four experiments with a spectral width of 100 kHz are done to check the spectral purity.
- **Phase cycling cancellation test** - from a series of twelve spectra, four single scan, four two scan subtractions and four four scan subtractions, the overall stability of the system can be evaluated.

- **Phase propagation test** - In a sequence with a 90 degree pulse along X and a 90 degree pulse with the phase varied in 10 degree steps the phase propagation can be observed.
- **Phase shifting test** - In a series of 37 experiments the pulse phase is shifted in 10 degree steps from 0 to 360 degrees.
- **Phase stability test "13 degree test"** -under the standard conditions for this test 32 experiments are acquired.
- **Pulse calibration test** - the signals resulting from 180, 360, 540 and 720 degree pulses are recorded 4 times each.
- **Quad image test** - The spectra resulting from four single scans and four four scan experiments are recorded. DQD is turned off for this test.
- **Receiver gain test** - this test demonstrates the dependence of the Signal to Noise ratio as a function of the receiver gain setting. The test is performed twice, once without and once with oversampling and digital filtering. The results are presented as the experimental spectra and as graphs of the log of signal intensity vs. RG and S/N vs. RG.
- **Turn on test "Dante test"** - In this test a series of experiments is recorded with the excitation pulse being generated in the following way, one 20 usec pulse, ten 2 usec, twenty 1 usec and one hundred 0.2 usec pulses
- **Turn on test** - the length of the excitation pulse is linearly increased from 50 nanoseconds to 500 nanoseconds in 12.5 nanosecond steps.

HWTmod tests *4.5*

- **Excitation profile I** - the excitation profile of a 16 microsecond gaussian pulse is recorded.
- **Excitation profile II** - the excitation profile of a 6 millisecond gaussian pulse is recorded.
- **Modulator linearity test** - using square pulses with different peak amplitudes the linearity of the modulators is tested.
- **Shaped pulse amplitude linearity test** - the amplitude linearity test based on 6dB amplitude changes and pulse doubling from the HWTgen section is repeated with gaussian shaped pulses.
- **Shaped pulse amplitude stability test** - the amplitude stability test from the HWTgen section is repeated with gaussian shaped pulses.
- **Shaped pulse comparison** - the signal intensities from a square, gaussian and EBURP pulse are compared. The rf amplitudes or durations of the pulses are calculated based on the initial hard pulse.
- **Shaped pulse modulator linearity test** - The HWTmod modulator linearity test from above is repeated with shaped pulses.
- **Shaped pulse phase stability test "13 degree test"** - - the 13 degree test from the HWTgen section is repeated with gaussian shaped pulses.

HWTgrad tests *4.6*

- **Amplitude stability after gradient echo** - demonstrates stability of the gradient amplifiers. A pair of gradients with opposite amplitudes follows an rf pulse. The amplitude of the resulting signal is analyzed for amplitude variation.
- **Amplitude stability after gradient pulse** - The amplitude stability test from HWTgen is repeated. Before the rf pulse, a gradient is applied and the test is run three times with different gradient durations and strengths.
- **Gradient recovery test** - the recovery of the signal after a gradient is recorded from 10 microseconds to 100 microseconds.
- **Phase cycling cancellation after gradient** - the cancellation test from HWTgen is repeated after the application of a gradient.
- **Z-gradient profile** - an acquisition is performed in the presence of a gradient

Short description of all tests

Running HWT tests - a short summary

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1. Type ***hwt*** inXWIN-NMR
2. Check ***current probe***
3. Select a ***dataset name*** (leave empty for default name)
4. Check for correct ***sample changer*** entry
5. Select the experiment group ***HWT***
6. Select an existing ***filename of group*** or type in a new name
7. Select tests from the left-hand side selection window
8. Delete tests in the right-hand side selection window
9. Change the holder positions with the ***Modify holder*** button
10. Change AU program arguments with the ***Edit au prog*** button
11. Save your selection with ***Save***
12. Start the HWT run with ***Start***

Running HWT tests - a short summary

Glossary

6

- HWT HardWare Tests:
  started with the command ***hwt***
- GLP Good Laboratory Practice tests:
  started with the command ***glp*** (see Manual H9532)
- SVT Software Validation Tests:
  started with the command ***glp*** (see Manual H9532)
- ATP Automatic Test Procedures:
  started with the command ***atp***
- FTA Final Test and Acceptance tests:
  started with the command ***atp***

Glossary