Recording Measurement Results over Time with Audio Analyzer R&S® UPV
Application Note

Products:

| R&S®UPV

| R&S®UPV66

| R&S®UPV-K1

This application note describes how measurement results can be logged over time in the audio analyzer R&S® UPV. A Visual Basic.NET application program is included which stores results to ASCII files.

ROHDE&SCHWARZ

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1 Introduction

In complex measurement tasks, the most basic type of measurement which consists of one acquisition producing one result value is more or less the exception. Most measurements produce a series of results. In many cases one or more parameters of the test signal are varied systematically, like in a frequency response or level sweep. In other cases it is desired to document changes in a signal or in properties of a device under test, which occur over time. Examples of such tasks include the level of acoustic noise or the distortion of a transducer in a long-term durability test.

The basic functionality of the R&S® Audio Analyzer UPV, further herein below called "UPV", provides functionality for recording measurement results on a time axis. This functionality is described in chapter 2.

While this solution is easy to use and available from the standard user interface, it is limited to a maximum of 1024 results per scan. For longer-term records, an application program is proposed in chapter 3.

2   Using the Time Tick Sweep

2.1 Principle of the Functionality

Sweeps plot the value of a measurement result versus a parameter which may be test tone frequency, test tone level or just elapsed time. A sweep varies the specified parameter in steps and starts a single measurement for each sweep step. The results are plotted in one of the four sweep graphs on the Y axis versus the sweep parameter on the X axis.

While a sweep vs. test tone frequency or level is configured in the "Sine" function of the generator function panel, and a sweep vs. the center frequency of selective RMS measurement is configured in the analyzer function panel, the sweep vs. time is configured in the start condition field of the analyzer config panel. The sweep comprises a specified number of points spaced apart by a specified time interval. The time tick starts a single measurement every time another instance of the time interval has elapsed.

Essential for this principle is that the maximum measurement time must not exceed the specified interval of the time tick.

2.2 Setting the Start Condition

Set "Start Condition" to "Time Tick" on bottom of the analyzer config panel. Parameter "Time" specifies the interval between the start of two subsequent measurements. "Points" sets the total number of measurements to be recorded. The length of the sweep will be Points * Time.

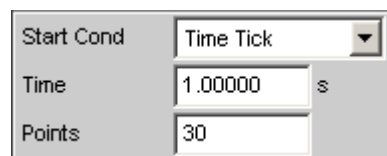| Start Cond	Time Tick	
Time	1.00000	s
Points	30	

Figure 1: Setting the time tick start condition

2.3 Configuring the Measurement

Most important for the configuration of the analyzer measurement function is the measurement time which must not exceed the time tick "Time" value. Measurements which are not FFT-based offer a "Meas Time" or "Interval Time" parameter which can be set to "Value".
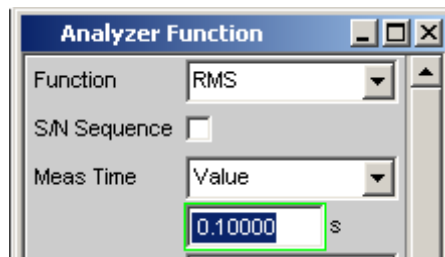
Figure 2: Setting the measurement time in the analyzer function panel

With FFT-based measurements, the measurement time depends on the FFT size. With distortion measurements, the FFT size depends on the fundamental frequency. Therefore, if possible, setting a fix fundamental frequency should be preferred to "Auto" because an erroneously measured low fundamental frequency e.g. with missing signal would lead to a large FFT size and therefore a long measurement time. With 1/n octave measurements, the FFT size depends on the resolution n and the lower frequency limit which can be set in the analyzer function panel.
In any case, the FFT size for a FFT-based measurement with fix parameters (no "Auto" settings) can be determined by temporarily activating the "Post FFT" checkbox.

Figure 3: Post FFT in the analyzer function panel

The acquisition time in seconds is FFT size divided by the sample rate (48 kHz for 22 kHz bandwidth, 96 kHz for 40 kHz bandwidth, 192 kHz for 80 kHz bandwidth and 768 kHz for 250 kHz bandwidth). The measurement time is the acquisition time plus some extra processing time.

2.4   Configuring the Sweep Graph

When the start condition in the analyzer config panel is set to "Time Tick", the X axis in the sweep graphs is set to represent time:
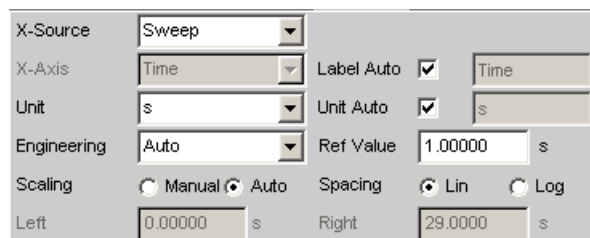

Figure 4: X axis settings in the sweep graph config panel for time tick

If the scaling is set to "Auto", the "Left" value of the X axis scaling is zero and the "Right" value is set to the maximum occurring time (Time * (Points -1)) of the time tick settings.

Select one of the available measurement result in the "Y Source" combobox of each active trace and configure unit, engineering and Y axis scaling as desired.
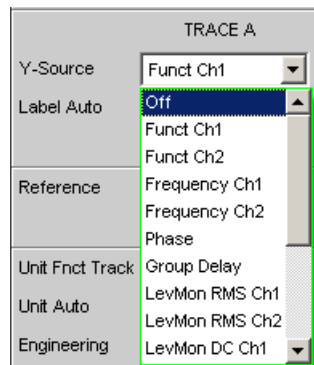

Figure 5: Setting the Y source of a trace in the sweep graph config panel

2.5 Starting a Record

A record is one sweep of the sweep system which is started by pressing the "SINGLE" button on the front panel. The status line on the bottom of the UPV window shows the sweep status and the measurement status of each analyzer channel, e.g. a potential overrange condition.
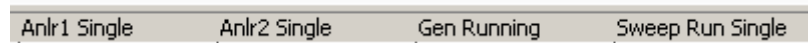

Figure 6: Status line in the UPV window

2.6 Reading the Results
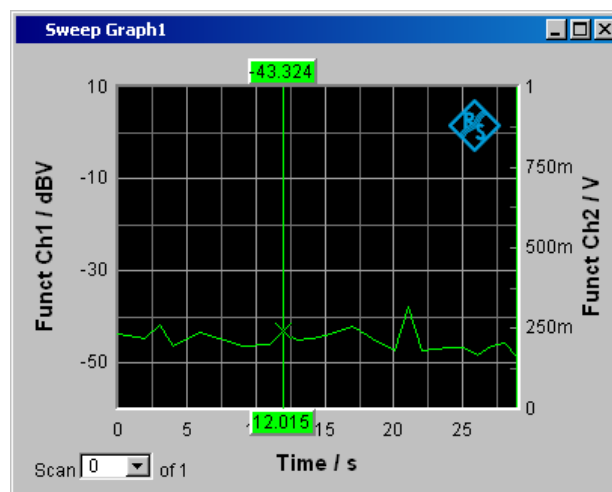
The results can be viewed over time in the sweep graph.

Figure 7: Sweep graph with cursor

Numeric results can be obtained with one of the cursors from the sweep graph. Set "Movement" in the sotkey context menu of the cursor to "Next Step".

A table of all results is available in a data list which can be opened by clicking the "Show" button besides "Data List" in the respective sweep graph config panel.
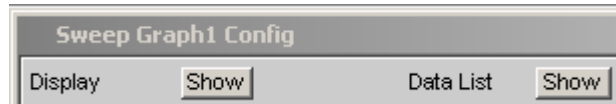
Figure 8: Opening the data list

Figure 9: Data list with results from time tick sweep

2.7 Saving the Results to a File

The results from the time tick sweep can be saved to a trace file. The controls for this purpose can be found at the bottom of the sweep graph config panel.

Figure 10: Storing a list of measurement values over time to a trace file

Trace files are stored in Tab-separated ASCII format and can therefore easily be viewed in a text editor or imported to a spreadsheet. For details of the file format and contents please see chapter 5.56.1 of the UPV user manual.

3 Application Program for Long-Term Records

3.1 Principle of the Application Program

Similar to the "Time Tick" start condition, the application program triggers single measurements in predefined time intervals. However, the obtained results are not shown in a sweep gra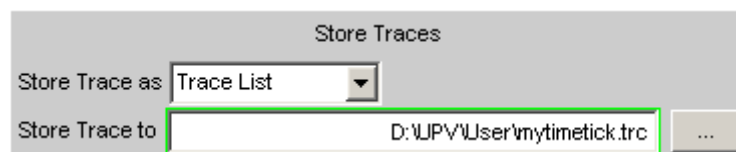ph but stored in an ASCII file, one row per trigger with the results obtained from different channels and sources sorted into columns. Due to this, the amount of data which can be recorded is virtually only limited by the hard disk capacity.

The ASCII data can be imported to a spreadsheet where the results can be graphically displayed.

3.2 Installing the Software

3.2.1 Prerequisites

The application program runs on UPV with firmware 3.0 or higher.
Option UPV-K1 "Universal Sequence Controller" is required.

3.2.2 Required File

Copy the installer "1GA59.msi" to the UPV harddisk, e.g. to "D:\R&S Software\Application Notes".

3.2.3 Installation

Start the installation file "1GA59.msi" and follow the instructions on the screen.

3.3 Using the Application Program

3.3.1 Starting the Program

The installer creates shortcuts "1GA59 Measurement Recorder" on the desktop and in the folder "R&S UPV Applications" of the programs menu.

The executable "MeasurementRecorder.exe" can be found in "C:\Program Files\Rohde&Schwarz\1GA59".

It is possible to assign one of the quick launch buttons in the UPV toolbar for starting the application program.

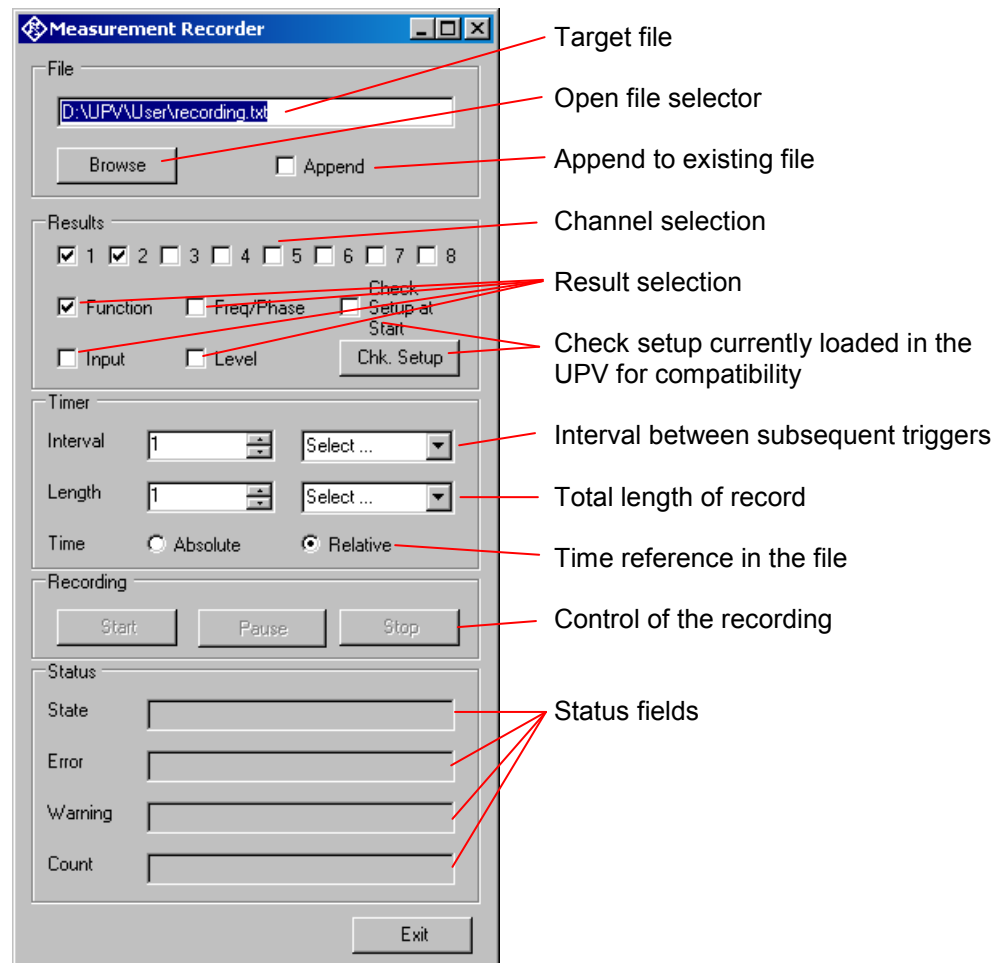## 3.3.2 The User Interface

Figure 11: User interface of the application program

3.3.3 Preparation and Start of a Measurement Series

3.3.3.1 "File" group box

Enter a file name for the target file in the textbox on top of the window. If necessary, a file selector box can be opened with the "Browse" button. If new records are to be appended to an existing file, tick the "Append" checkbox.

3.3.3.2 "Results" group box

In the "Results" group box, measurement channels and results can be selected for recording. The program supports up to eight analyzer channels. Channels which are ticked here must be active in the setup which is currently loaded in the UPV. Further checkboxes allow to select results from the main analyzer function, input monitor, level monitor and frequency measurement for being recorded in the file. The respective measurement functions must be activated in the current UPV setup.

The "Chk Setup" button allows to quickly check whether all required channels and measurement functions are currently active in the UPV. Discrepancies are displayed in message boxes. If no incompatibilities are found, another message box announces the successful check.

Another checkbox allows to automatically do this setup check before each start of a measurement recording.

3.3.3.3 "Timer" group box

In the timer group box, the interval between two subsequent measurement triggers can be set in seconds, minutes or hours. The total length of the recording can be set in terms of seconds, minutes, hours, days or samples (i.e. intervals).

Note that for both settings units must be selected before a recording can be started.

3.3.3.4 Control of the recording

As soon as the timer is set, recording can be started with the "Start" button. Recording ends automatically and the output file is closed as soon as the total recording length has expired. The recording can also be ended by clicking the "Stop" button. The "Pause" button suspends the triggering of measurements and recording of results until it is actuated again. Note that the end of the recording is not postponed by this action. Missed triggers are not appended at the end of the specified total length.

3.3.4 Content of the Status Fields

The "State" can be "Running", "Paused" or "Stopped".

The "Error" field displays SCPI errors reported from the UPV firmware.

In the "Warning" field a message appears when a measurement has taken longer than the specified interval. In such a case on or more of the subsequent triggers are without effect and produce no results. The next measurement is started at the next trigger occurring after the measurement has completed.

The "Count" field displays the number of triggered measurements.

3.3.5 Format of the Output File

In the output file, columns can be Tab-delimited (*.txt) or comma-delimited (*.csv).

The first row contains column headers indicating the source of the measurement results (function, input monitor, level monitor and frequency/phase measurement) together with the channel number. Only channels which are active in the UPV setup and selected in the user interface of the application program are assigned to columns.

	A	B	C	D	E	F	G	H	I	J
1	Index	Time	Fct(Ch1) / dBu	Fct(Ch2) / V	Inp(Ch1) / V	Inp(Ch2) / V	DC(Ch1) / V	DC(Ch2) / V	Freq_Phase(Ch1) / Hz	Freq_Phase(Ch2) / °
2	1	00:00:00	-17.73461723	0.080040738	0.151243568	0.113241985	0.010030631	6.11381E-05	1000	24.9993515
3	2	00:00:01	-17.73454285	0.080040321	0.151247606	0.113242678	0.010031292	6.37531E-05	1000	24.99955368
4	3	00:00:02	-17.73456764	0.080042206	0.151245356	0.113243818	0.010027449	6.08836E-05	1000	24.99949455
5	4	00:00:03	-17.73464775	0.080041379	0.151244775	0.11324247	0.010026814	6.08212E-05	1000	24.99938583
6	5	00:00:04	-17.73461914	0.080041856	0.151244938	0.113244072	0.010027286	0.00006082	1000	24.99947166
7	6	00:00:05	-17.73459816	0.08004126	0.151246682	0.113243215	0.010027476	6.11391E-05	1000	24.99950981
8	7	00:00:06	-17.73466682	0.08004085	0.151245445	0.113243982	0.010027357	6.09109E-05	1000	24.99933052
9	8	00:00:07	-17.73465729	0.080040805	0.151243761	0.113242611	0.010026922	6.08901E-05	1000	24.99962616
10	9	00:00:08	-17.73453903	0.080040894	0.151246101	0.113242306	0.010027241	6.10032E-05	1000	24.99941254
11	10	00:00:09	-17.73451805	0.080040358	0.151246592	0.113242142	0.010027275	6.09651E-05	1000	24.99939346
12										

Figure 12: Example output file, imported to a spreadsheet

The first column of each row contains a row number. The second column contains time information, either relative time from start of the recording or absolute time from the Windows XP system clock.

3.4 Working with the Source Code

3.4.1 Loading the Source Code to the IDE

- Download "1GA593_VB2003.zip", "1GA59_VB2005.zip" or "1GA59_VB2008.zip" according to the version of the VB.Net IDE installed on the UPV
- Unzip the file to the VB.Net projects folder on the UPV hard disk
- Open file "MeasurementRecorder.sln" from the VB.Net IDE

3.4.2 Modifying the program

The user interface and program code can be modified and enhanced in the editor according to special requirements.

Open the solution explorer in the IDE, right-click on "Form1.vb" and Click "View Designer" or "View Code", respectively.

To add a new control to the user interface in the designer, select a control from the toolbox on the left side of the IDE window and drag it onto the window of the application program in the designer. Edit the appearance of the control in the "Properties" window. Double-click the new control in the designer and enter code in the source code editor which is to be executed upon actuation of this control.

4 Literature

- R&S UPV Operating Manual

5 Ordering Information

Ordering Information		
Type of instrument		
Description	**Instrument type**	**Ordering number**
Audio Analyzer	R&S®UPV or	1146.2003.02
	R&S®UPV66	1146.2003.66
Universal Sequence Controller	R&S®UPV-K1	1401.7009.02

About Rohde & Schwarz

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- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system

Certified Quality System
ISO 9001

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