



Products: R&S<sup>®</sup> SMU200A, R&S<sup>®</sup> SMJ100A, R&S<sup>®</sup> SMATE200A,  
R&S<sup>®</sup> SMBV100A,  
R&S<sup>®</sup> AFQ100A, R&S<sup>®</sup> AFQ100B, R&S<sup>®</sup> AMU200A

## Converting Existing Waveform Files from R&S<sup>®</sup> AMIQ or Binary into R&S<sup>®</sup> SMU200A or R&S<sup>®</sup> AFQ100A Format.

### Application Note

This application note describes how to use the Rohde & Schwarz software tool 'RsBatchConvert.exe' for the conversion of binary data or WinIQSIM generated AMIQ waveforms into the new<sup>1</sup> waveform format. The tool not only rescales I/Q data contained in the file but also changes the K-option requirement from WinIQSIM Kxx to the new WinIQSIM2 K2xx options. Thus, new instruments with installed K2xx options may be used to continue using existing waveform files.



---

<sup>1</sup> The term 'new' is related to the instruments SMU, SMJ, SMATE, SMBV, AFQ and AMU.

## Contents

1	Note.....	2
2	Overview .....	3
3	Features.....	3
4	Hardware and Software Requirements .....	3
	PC Hardware Requirements .....	3
5	Release Notes.....	4
6	Installation .....	4
7	Using the Software.....	4
	Calling Convention .....	4
	Command Line Options .....	5
	-recursive .....	5
	-overwrite .....	5
	-indir <input directory> .....	5
	-outdir <output directory> .....	5
	-ext <search extension>.....	6
	-clock <ARB clock rate / MHz> .....	6
	-comment “<comment>” .....	6
	-copyright “<copyright>” .....	6
	-gain <gain value / dB> .....	6
	-v <verbosity level> .....	6
	-format <format identifier> .....	7
8	K-Option Translation .....	8
9	Evaluated AMIQ Waveform Tags .....	9
10	Evaluated Tags in Text Files.....	10
11	Examples .....	10

## 1 Note

The following abbreviations are used throughout this application note for Rohde & Schwarz test equipment:

- The R&S® AMIQ I/Q Modulation Generator is referred to as AMIQ
- The R&S® SMU200A Vector Signal Generator is referred to as SMU
- The R&S® SMJ100A Vector Signal Generator is referred to as SMJ
- The R&S® SMATE200A Vector Signal Generator is referred to as SMATE
- The R&S® SMBV100A Vector Signal Generator is referred to as SMBV
- The R&S® AFQ100A I/Q Modulation Generator is referred to as AFQ
- The R&S® AFQ100B I/Q Modulation Generator is referred to as AFQ
- The R&S® AMU200A Baseband Signal Generator and Fading Simulator is referred to as AMU

Other product and company names mentioned herein are trademarks or trade names of their respective companies.

## 2 Overview

This application note describes how to use the Rohde & Schwarz software tool 'RsBatchConvert.exe' for the conversion of binary data or WinIQSIM generated AMIQ waveforms into the new<sup>2</sup> waveform format. The tool not only rescales I/Q data contained in the file but also changes the K-option requirement from WinIQSIM Kxx to the new WinIQSIM2 K2xx options. Thus, new instruments with installed K2xx options may be used to continue using existing waveform files. Chapter 8 in this document provides details about the K-option translation process.

RsBatchConvert also offers batch processing capabilities that may be utilized to convert a large number of files with a single call.

## 3 Features

RsBatchConvert provides the following functionality:

- Run as command line application, no additional dependencies on other software packages
- Import and convert various text and binary I/Q data formats
- Convert R&S AMIQ waveform files and change the Kxx option into the corresponding K2xx option
- Process all files located in sub directories

## 4 Hardware and Software Requirements

### PC Hardware Requirements

	Minimum	Recommended
<b>CPU</b>	1 GHz	> 1 GHz
<b>RAM</b>	256 MByte	512 MByte
<b>Hard disc</b>	10 MByte free space	> 50 MByte free space <sup>3</sup>
<b>Monitor</b>	XVGA 1024x768	> XVGA 1024x768

---

<sup>2</sup> The term 'new' is related to the instruments SMU, SMJ, SMATE, AFQ, SMBV and AMU.

<sup>3</sup> RsBatchConvert creates temporary files during waveform conversion. The required space thus depends on the size of the waveforms that need to be converted.

## 5 Release Notes

V 1.1.0	first official release
V 1.2.0	16 bit resolution used by default
V 1.3.0	sample count from WAVEFORM tag supersedes data from SAMPLES tag
V 1.5.0	fixed missing marker data error when importing from binary or ASCII files renamed command line options new option for auto scaling
V 1.6.0	clock rate limit raised to 600 MHz fixed multiple bugs in handling marker data when converting AMIQ files

## 6 Installation

The RsBatchConvert software does not need any specific installation procedure. It is bundled with this manual in a zip archive.

`'RsBatchConvert_<version number>.zip`

Extract the content of the archive to any location on your local hard drive. After unpacking the zip archive the RsBatchConvert software should be called from the Microsoft Windows command line interface. Make sure all DLL files reside in the same directory with your executable.

## 7 Using the Software

### Calling Convention

The RsBatchConvert software is a command line application and thus shall be started from a Microsoft Windows command line interface. Command line options are used to configure the software and control its actions.

```
RsBatchConvert [single file] <options>
```

The first parameter is optional and only used if a single file shall be processed. In this case the current working directory is searched for the input file. The output file name is generated from the input file name by adding the prefix 'new-'.

If no options are provided the software prints out a brief help text that lists all available options. The following paragraph discusses all options in detail.

*Note:*

*Before starting the application verify your current working directory as RsBatchConvert may automatically descend into all sub directories for the searching of available files (-recursive option).*

*The program creates temporary files in the current working directory while processing files. It is therefore suggested to call RsBatchConvert from drives with fast read- and write-access.*

### Command Line Options

#### **-recursive**

This option allows RsBatchConvert to recursively descend into sub directories while searching for input files. Without this option only files from the directory specified by the *-indir* option are evaluated. By default RsBatchConvert does not descend into sub directories.

This option is not valid if only one single file is processed.

#### **-overwrite**

This option allows RsBatchConvert to overwrite existing output files. If this option is omitted the software prompts the user before attempting to overwrite an existing file (default).

This option is not valid if only one single file is processed since the name of the output file is always the input file name with 'new-' added as prefix.

#### **-indir <input directory>**

This option specifies the input directory for files that are to be processed by the RsBatchConvert software. The program may automatically descend into all sub directories to search for available files (*-recursive* option). The input directory path can be absolute or relative to the current working directory. Use a path starting with a drive letter or starting with a backslash as absolute path. The following examples show how path information is interpreted:

`-indir C:\myfiles\indata\` searches in the absolute path on the C drive

`-indir \myfiles\indata` searches in the absolute path on the actual drive

`-indir indata` searches in the sub directory indata relative to the current working directory

`-indir ..\otherfiles` searches in one directory level up and then descends into the sub directory otherfiles

If this option is omitted RsBatchConvert uses the current working directory.

This option is not valid if only one single file is processed. In single file mode the current working directory is searched.

#### **-outdir <output directory>**

Specifies the location where the converted files are placed. The same rules apply to this option as mentioned for *-indir*. Make sure to use different in- and out- directories when converting waveform files since both use the same .wv extension and new files may overwrite existing ones. While RsBatchConvert parses sub directories and converts files it creates the same directory structure in the output path.

This option is not valid if only one single file is processed. In single file mode the current working directory is used for the output file.

### **-ext <search extension>**

This option sets the file extension that RsBatchConvert uses to determine valid input files. Only files with matching extension are processed.

Example:        -ext wv                                process \*.wv files only

This option is not valid if only one single file is processed. If this option is omitted all files in the input path are processed.

### **-clock <ARB clock rate / MHz>**

Use this option to set the clock rate for all output files. This option is only valid for input file formats that do not contain any clock rate information, e.g. pure binary I/Q data. The option is ignored when converting AMIQ waveform files. The clock rate is specified in MHz.

Example:        -clock 5.384                            sets the clock rate to 5.384 MHz

### **-comment "<comment>"**

Use this option to set an optional comment text that is added to all output files. The comment text should be enclosed in quotation marks.

Example:        -comment "my new files"                    add the text to all files

### **-copyright "<copyright>"**

Use this option to set an optional copyright text that is added to all output files. The copyright text should be enclosed in quotation marks.

Example:        -copyright "my new files"                    add the text to all files

### **-gain <gain value / dB>**

This option may be used to specify a gain for rescaling waveform data during the conversion process. The gain value is provided in dB (  $20 \log$  ) and thus a value of 0 dB leaves the level unchanged. A value of 20 dB corresponds to a factor of 10. Negative values reduce the output level whereas positive numbers increase the level.

Example:        -gain -6.0                                        reduces the signal amplitude to 0.5

### **-autoscale**

This option automatically scales waveforms with small signal level to full scale. It is particularly useful when waveform data is created from floating point I and Q readings and the full dynamic range of the ARB shall be used. This option has no effect when converting AMIQ waveforms.

### **-v <verbosity level>**

This option may be used to let RsBatchConvert generate debug information during the data conversion process. The level can be set to 1,2 or 3.

- 1        =        show errors only (default)
- 2        =        show warnings and errors
- 3        =        show information, warnings and errors

### **-format <format identifier>**

This option is required to set the input format for the conversion process. All files are required to have the same format during a conversion run. The following table explains supported formats:

<u>Identifier</u>	<u>Format</u>
rsamiq	AMIQ or SMIQ waveform file (*.wv), (14 bit and 16 bit)
txt	ASCII, two columns of float numbers, additional header information may be provided to set parameters such as clock rate
txt2ui16	ASCII, unsigned integer, 16 bit, one file .I other file .Q
txt2ui14	ASCII, unsigned integer, 14 bit, one file .I other file .Q
txthex	ASCII, hex, signed integer, 16 bit
f32be	IEEE, floating point, single precision (32 bit), big endian
f32le	IEEE, floating point, single precision (32 bit), little endian
i16be	Signed integer, 16 bit, big endian
i16le	Signed integer, 16 bit, little endian
i14be2	Signed integer, 14 bit, big endian, one file .I other file .Q
i14le2	Signed integer, 14 bit, little endian, one file .I other file .Q

The choice of big endian or little endian depends on the computer platform that was used to generate I/Q data.

big endian: Motorola, Coldfire, PowerPC, Sun SPARC, HP-UX

little endian: Intel, Microsoft Windows

### **8 K-Option Translation**

RsBatchConvert translates WinIQSIM K-options into the newer WinIQSIM2 K2xx-options. The following table describes how options are translated.

<u>WinIQSIM K-option</u>	→	<u>WinIQSIM2 K-option</u>
<b>K11</b> IS-95	→	<b>K246</b> CDMA2000
<b>K12</b> CDMA2000	→	<b>K246</b> CDMA2000
<b>K13</b> 3GPP TDD	→	no K-option
<b>K14</b> TD-SCDMA	→	<b>K250</b> TD-SCDMA
<b>K15</b> OFDM	→	no K-option
<b>K16</b> 802.11b	→	<b>K248</b> 802.11
<b>K17</b> 1xEV-DO	→	no K-option
<b>K18</b> 802.11a	→	<b>K248</b> 802.11
<b>K19</b> 802.11	→	<b>K248</b> 802.11
<b>K20</b> 3GPP FDD	→	<b>K242</b> 3GPP FDD
no K-option	→	no K-option

#### WinIQSIM2 K-options (K2xx)

These options remain untouched.

#### New Instrument K-options (Kxx)

These options remain untouched.



### **9 Evaluated AMIQ Waveform Tags**

RsBatchConvert treats waveform files slightly different than the AMIQ instrument would do. This paragraph outlines the differences and helps to understand the conversion result.

*Tag {TYPE: ...}*

Both, WV and WV-ADD are treated exactly the same way. This is because newer instruments do not differentiate anymore.

*Tag {CLOCK: ...}*

The optional keyword SLOW or FAST is ignored.

*Tag {TARGET: ...}*

This tag is ignored since it is only valid for WV-ADD waveforms.

*Tag {FILTER: ...}*

This tag is ignored since newer instruments do not require this setting anymore.

*Tag {MARKER LIST x: start-end:value; ...}*

This tag is currently not supported. Use the transition format of this tag instead. Marker tags override tag data that is incorporated into the waveform.

*Tag {IDLE SIGNAL: ...}*

This tag is ignored since this function is not required for the newer instruments anymore.

*Tag {RESOLUTION: ...}*

If one or the other value is set to 16 bits RsBatchConvert reads all I/Q data using the 16 bit format. Marker data is evaluated from the marker tags only and added to the output waveform.

#### ***Multi Segment Waveforms***

All tags related to multi segment waveforms are currently not evaluated and will not be contained in the output file.

#### ***Marker Data***

Marker tags are evaluated regardless of the resolution setting. This is because newer instruments handle markers separately and thus allow you to combine markers with 16 bit I/Q data. Marker tags supersede marker data from I/Q data (lower two bits of I and Q). Thus, existing marker tags turn off the evaluation of markers incorporated into the I/Q data block. If no marker tags are prevalent the lower two bits of the I and Q data are converted into marker traces one through four (if the resolution is set to 14 bits).

## 10 Evaluated Tags in Text Files

The ,txt' format reads data from an ASCII file that contains I and Q values in separate columns. Additional tags may be used to add specific information content.

COMMENT = <comment>

The comment text is added to the waveform output file. This tag is optional.

COPYRIGHT = <copyright>

The copyright text is added to the waveform output file. This tag is optional.

CLOCKRATE = <ARB clock / Hz>

This tag sets the clock rate. If the clock rate is not set by this tag it needs to be provided using the command line option *-clock*.

## 11 Examples

### Converting one single file:

```
RsBatchConvert MyAmiqFile.wv -format rsamiq
```

This call converts the input file 'MyAmiqFile.wv' into the new waveform file named 'new-MyAmiqFile.wv'.

### Converting AMIQ waveforms from current directory:

```
RsBatchConvert -outdir outfiles -ext wv -format rsamiq
```

This call processes all \*.wv files from the current working directory. All output files are placed into the sub directory called 'outfiles'. Existing files are not automatically overwritten.

### Converting directory tree with AMIQ waveforms:

```
RsBatchConvert -recursive -overwrite -indir amiqdata  
-outdir smudata -ext wv -format rsamiq
```

This call processes all available \*.wv files in the directory amiqdata and all its sub directories. The directory structure under amiqdata is replicated under smudata and all output files are placed at the appropriate location. Existing output files are overwritten without asking.

---

### **Converting one or more binary files:**

```
RsBatchConvert -ext bin -format f32le  
                -clock 38.4 -comment "3GPP waveform"
```

This call converts all files (float, 32 bit, little endian) that are located in the actual working directory and ending on .bin into waveform files. The clock rate for the output files is set to 38.4 MHz and the comment "3GPP waveform" is added.