Waveform Libraries and Tools

For broadcasting T&M equipment from Rohde & Schwarz

ROHDE&SCHWARZ

Waveform Libraries and Tools

At a glance

When it comes to developing, producing and testing TV components and devices, suitable test signals are needed. To meet these needs, Rohde&Schwarz offers test transmitters and modulators with real-time coders as well as solutions based on arbitrary waveform generators (ARBs) in combination with a large number of I/Q waveform libraries and intelligent software.

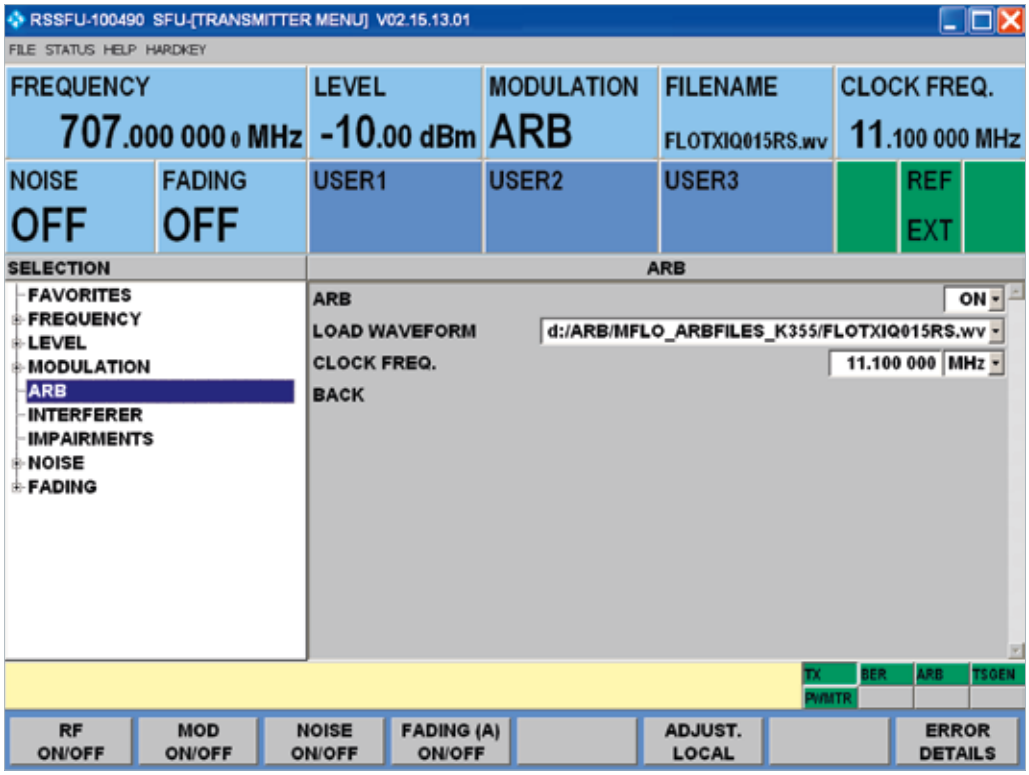
Computer simulation programs are often used in the development of receivers and chipsets. These simulation programs let users output I/Q samples as waveforms. Such waveform files usually only contain pure test patterns, and no video or audio signal content. These simulated waveforms are supported by the arbitrary waveform generators of the R&S®SFx family. Rohde&Schwarz also offers waveform libraries for numerous analog and digital broadcasting signals used worldwide.

The waveform libraries from Rohde&Schwarz provide simple and fast access to standard-compliant and predefined signals, and also help ensure their reproducibility. The standard-compliant waveform files contain all of the information included in video, audio and data sequences as well as other transmission parameters.

The wide range of intelligent software tools enables users to generate broadcast interference signals and wireless communications signals.

Key facts

- Support of the R&S®SFU, R&S®SFE and R&S®SFE100 signal generators
- Numerous transmission standards
- Signal generation for broadcasting and wireless communications
- Standard-compliant I/Q waveform files
- Defined and verified test scenarios



Waveform files are easy to use with instruments from the R&S®SFx family (here R&S®SFU).

Waveform Libraries and Tools

Benefits and key features

Large variety of applications

- Many different test cases
- Development of receivers and chipsets
- Complex interference signals from the world of broadcasting and wireless communications
- Testing of broadcast receivers
- Use in production

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High-quality signal content for numerous transmission standards

- Support of numerous transmission standards
- High-quality video, audio and data sequences
- Standard-compliant test signals and scenarios with different types of coding

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Fast and simple testing

- Highly complex tests at the press of a button
  - Easily configurable test scenarios
  - Simple handling of complex test scenarios
- Reproducible test results

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Extensive collection of waveform libraries [1] for

- Digital TV
  - DVB-T2 waveforms
- Mobile TV
  - DVB-H waveforms
  - T-DMB waveforms
  - DAB waveforms
  - CMMB waveforms
  - MediaFLO™ waveforms
- Audio broadcasting
  - DRM waveforms
  - DRM+ waveforms
  - HD Radio™ waveforms
- Interferers
  - Digital TV interferer waveforms
  - Cable interferer waveforms
  - Analog signal waveforms

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Devices supporting the waveform libraries

- R&S®SFU broadcast test system
- R&S®SFE broadcast tester
- R&S®SFE100 test transmitter

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Intelligent software tools for generating signals

- Waveform file conversion with the I/Q converter from Rohde&Schwarz
- Wireless communications signal generation with R&S®WinIQSIM2™ software

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[1] Waveform libraries are preprogrammed I/Q signals which are played out by the ARB generator option (R&S®SFx-K35).

Large variety of applications

Many different test cases

Waveform libraries from Rohde&Schwarz cover many different fields of application. They are used either to supplement a realtime coder or in purely ARB-based solutions. Typical tests:

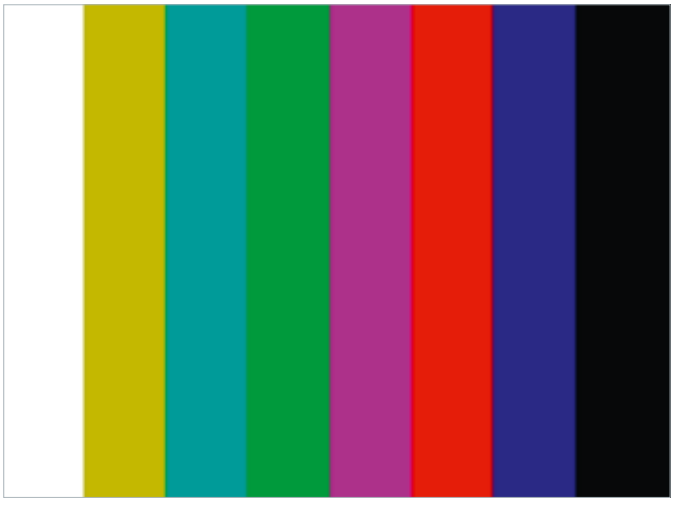
- Conformance tests: waveform file scenarios based on test specifications and test standards
- Performance tests: testing receivers beyond the limits specified in the standard
- Receiver tests: testing functionality defined in the transmission standard
- Decoder tests: functional tests to display video, audio and data content
- Development: all types of tests
- Production: typically, simple functional tests

Development of receivers and chipsets

Computer simulation programs are often used in the early stages of receiver and chipset development. These simulation programs let users output I/Q samples as I/Q waveform files which contain pure test patterns and no video or audio signal content.

In addition to these types of simulation signals, Rohde&Schwarz offers standard-compliant waveform files for numerous analog and digital broadcasting signals used worldwide. Fast and easy access to standard-compliant and predefined signals is a definite advantage. Development is faster and more reliable.

Test signal: "Flower sequence".



Test signal: "Color bars".

Complex interference signals from the world of broadcasting and wireless communications

Complex interference scenarios are mostly relevant in terrestrial and cable transmission. These include many signal combinations, from simple CW signals to complex, mixed analog and digital TV signals. The waveform libraries can be used to simulate cable channel occupancy for amplifier tests, to simulate interference in EMC tests and also for co-channel and adjacent-channel scenarios in sensitivity and selectivity tests.

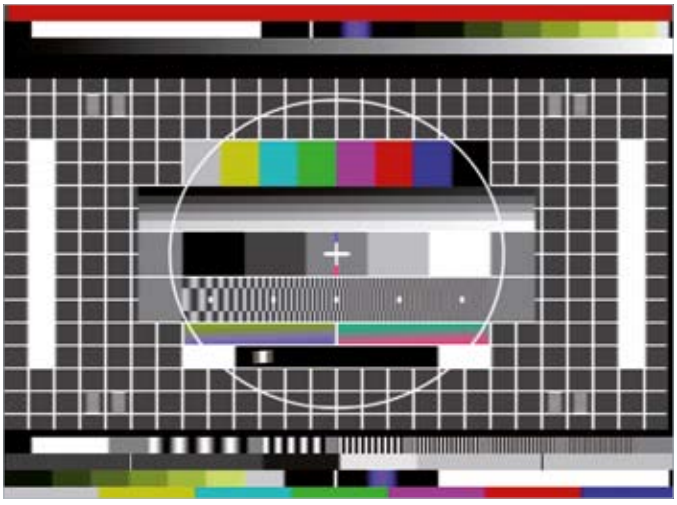
Examples of test standards that describe such scenarios are IEC 62002 (MBRAI), NorDig, D-Book and SCTE. Predefined I/Q waveform interference scenarios let users quickly and efficiently simulate such complex scenarios. Additional signal generation software enables users to create their own scenarios, including scenarios for wireless communications signals such as long term evolution (LTE).

Testing of broadcast receivers

Due to their signal properties, narrowband sound broadcasting signals can be mapped very well using I/Q waveform files. The relatively low bandwidth means long signal replay times even when the memory depth is low. The waveform libraries contain test scenarios tailored to the characteristics of transmission standards, e.g. DAB, DRM, DRM+ and HD Radio™.

Use in production

Waveform libraries from Rohde&Schwarz are also used in production. Mobile phone manufacturers, especially, use sequential production. Waveform libraries from Rohde&Schwarz make it possible to perform functional tests quickly during mass production. Video and audio content or all-zero or all-one test pattern sequences are used to show the results of these tests on DUTs.



Test signal: "Codec 4:3 and 16:9".

Test signal: "Diver sequence".

High-quality signal content for numerous transmission standards

Support of numerous transmission standards

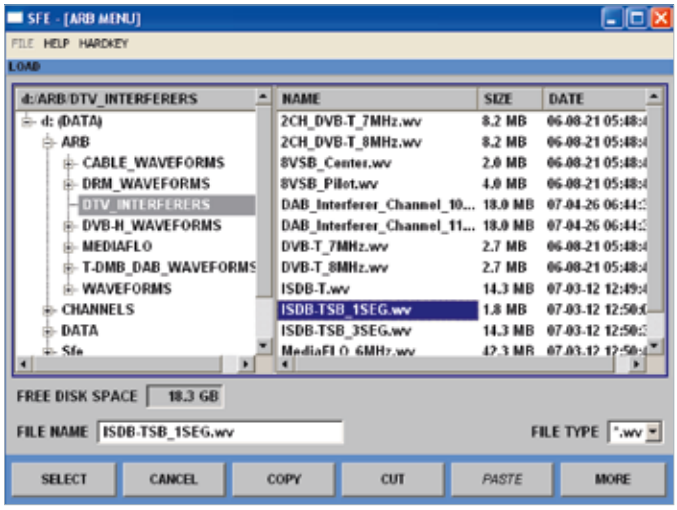
The waveform libraries from Rohde&Schwarz support a wide range of broadcasting technologies, from analog TV to the latest digital TV standards such as DVB-T2. Mobile TV standards such as Chinese CMMB and US MediaFLO™ are also supported, as are digital audio broadcasting standards such as DRM, DRM+, ISDB-T_{SB} and HD Radio™.

High-quality video, audio and data sequences

Waveform libraries from Rohde&Schwarz use high-quality video, audio and data sequences for their content. These sequences are stored in their original uncompressed form and are then processed as I/Q waveform files.

Standard-compliant test signals and scenarios with different types of coding

Using existing source material, various types of video, audio and data coding can be generated and made available as standard-compliant test signals and test scenarios. Depending on the application, the waveform files can contain decodable video, audio and data content, such as pseudo-random sequences. However, there are also waveform files that replay pure signal spectrum.



R&S®SFE ARB GUI: example of a waveform file.

ATV spectrum.

HD Radio™ spectrum.

Fast and simple testing

Highly complex tests at the press of a button

The capability to combine and select between signal generation based on realtime coding or arbitrary waveform files provides fast, intelligent solutions for any task. Using Rohde&Schwarz waveform libraries and their predefined test scenarios, it only takes a few seconds and the press of a button to set up highly complex test scenarios. Time-consuming and complex setups requiring many different signal generators and additional test equipment are eliminated.

Reproducible test results

Waveform files have predefined properties which uniquely identify the signals and their characteristics, form and content. These predefined properties make such waveform files easy to handle, even without in-depth knowledge of a standard's signal structure. Predefined parameters also make it possible to reliably reproduce test results.

Digital TV Interferers	Available Waveform Files

DAB_Interferer_Channel_1011.wv

This file occupies the T-DMB channels A, C and D within an 8 MHz channel.

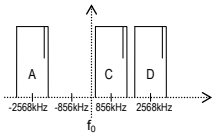


Figure 2-6: **Three channel T-DMB signal**

DAB_Interferer_Channel_1101.wv

This file occupies the T-DMB channels A, B and D within an 8 MHz channel.

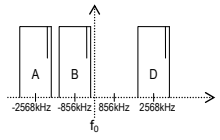


Figure 2-7: Three channel T-DMB signal

DAB_Interferer_Channel_1001.wv

This file occupies the two T-DMB channels A and D within an 8 MHz channel.

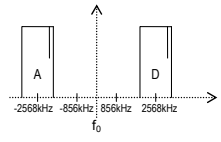
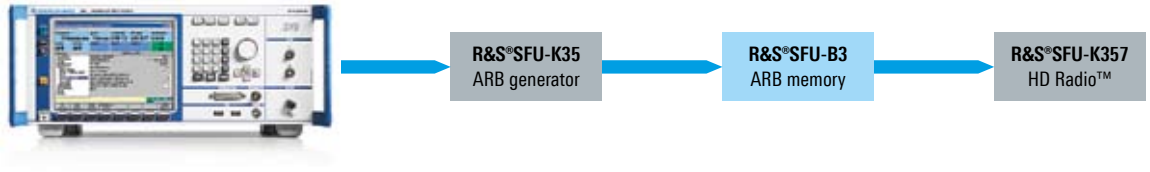


Figure 2-8: Two channel T-DMB signal

Example of a T-DMB DAB interference test scenario from the R&S®SFU-K354 digital TV interferers library (excerpt from the R&S®SFU-K354 manual).

R&S®SFU – example of a minimum configuration using I/Q waveform libraries



Extensive collection of waveform libraries

The following tables provide a general overview of the available waveform libraries and their content. Please refer to the respective data sheets and specifications for detailed information about the libraries.

Digital TV

DVB-T2 waveforms

R&S®SFU-K359 option	
Standard	DVB-T2
Sequence	single PLP (mode A), multiple PLP (mode B), SISO, MISO
Content	decodable digital video (H.264 with moving-picture sequence) and audio (AAC, music)
Playback	endless, not seamless
Applications	conformance tests, receiver tests, decoder tests, development

Mobile TV

DVB-H waveforms

R&S®SFU-K352 option	
Standard	DVB-H
Sequence	DVB-H service
Content	decodable digital video (H.264 with moving-picture sequence) and audio (AAC, music)
Playback	endless, not seamless
Applications	receiver tests, decoder tests, production

T-DMB/DAB waveforms

R&S®SFU-K351 option	
Standard	T-DMB and DAB
Sequence	T-DMB service and DAB service
Content	decodable digital video (H.264 with moving-picture sequence) with audio (AAC, music) and decodable audio MUSICAM (MP2) with test sound
Playback	endless, not seamless
Applications	receiver tests, decoder tests, production

CMMB waveforms

R&S®SFU-K358 option	
Standard	CMMB
Sequence	up to 9 CMMB services
Content	decodable digital video (H.264 with moving-picture sequence) with audio (AAC)
Playback	endless, not seamless
Applications	receiver tests, decoder tests, production

Available R&S®SFU waveform libraries

MediaFLO™ waveforms

R&S®SFU-K355 option	
Standard	MediaFLO™
Sequence	multiple MediaFLO™ services
Content	various Tx modes, FLO IDs, MLC IDs (Qualcomm MediaFLO™) decodable test access ports, no video, no audio
Playback	endless, seamless
Applications	receiver tests, development, production

Audio broadcasting

DRM waveforms

R&S®SFU-K353 option	
Standard	DRM
Sequence	DRM service (modes A, B, C, D)
Content	decodable digital audio (AAC, AAC with SBR), language (CELP, HVCX, HVCX with SBR), audio and data (AAC, AAC with SBR, CELP), PRBS
Playback	endless, not seamless
Applications	performance tests, receiver tests, decoder tests, development

DRM+ waveforms (in preparation)

R&S®SFU-K361 option	
Standard	DRM+
Sequence	DRM+ service
Content	TBD
Playback	endless, not seamless
Applications	receiver tests, decoder tests, development

HD Radio™ waveforms [2)]

R&S®SFU-K357 option	
Standard	HD Radio™
Sequence	FM, FM and digital radio, AM, AM mono and digital radio
Content	decodable analog and digital audio, data, acc. to iBiquity test vectors
Playback	endless, not seamless
Applications	conformance tests, receiver tests, decoder tests, development, production

[2)] A license from iBiquity is required for the HD Radio™ waveform library.

Interferers

Digital TV interferer waveforms

R&S®SFU-K354 option	
Standard	DVB-T2 (in preparation), DVB-T, FM/GSM Tx (IEC 62002 MBRAI, NorDig, D-Book), ATSC/8VSB (A.74), T-DMB, DAB, ISDB-T, ISDB-T_{SB}, DTMB, MediaFLO™
Sequence	terrestrial single-channel and multichannel scenarios
Content	partially non-decodable analog and digital audio and video, null packets
Playback	endless, not seamless
Applications	conformance tests, performance tests, receiver tests, development

Cable interferer waveforms

R&S®SFU-K356 option	
Standard	CW, NTSC M, DVB-C, J.83/B (SCTE)
Sequence	single-channel and multichannel scenarios, full channel load (up to 15 channels)
Content	non-decodable digital audio and video for DVB-C, J.83/B decodable digital audio and video for NTSC M
Playback	endless, seamless
Applications	conformance tests, performance tests, receiver tests, development

Analog signal waveforms

R&S®SFU-K360 option	
Standard	AM, FM, NTSC M, PAL B, PAL G
Sequence	single-channel and multichannel scenarios
Content	decodable analog video and audio
Playback	endless, seamless
Applications	conformance tests, performance tests, receiver tests, development

Devices supporting the waveform libraries

In addition to their realtime coders, all broadcast signal generators have integrated, powerful arbitrary waveform generator options to support the waveform libraries.

R&S®SFU broadcast test system

The R&S®SFU is a high-end multistandard broadcast test system for analog and digital TV and audio transmission standards – the multifunctional solution for all R&D applications including noise, fading and interference simulation.

R&S®SFE broadcast tester

The R&S®SFE is a general-purpose multistandard broadcast signal generator for analog and digital TV and audio transmission standards. The compact, lightweight, easy-to-use instrument is ideal for lab, quality assurance and manufacturing applications.

R&S®SFU broadcast test system.

R&S®SFE broadcast tester.

Various waveform libraries for the Rohde&Schwarz generators [1]

	Digital TV		Mobile TV		
Standard	DVB-T2	CMMB	MediaFLO™	DVB-H	T-DMB/DAB
Option	R&S®SFU-K359	R&S®SFU-K358	R&S®SFU-K355	R&S®SFU-K352	R&S®SFU-K351
Release	1.10	1.10	1.00	3.00	1.00
File format [2]	.wv	.wv	.wv	.wv	.wv
File size [3] (approximately)	226 Mbyte, up to 1 Gbyte	238 Mbyte, up to 953 Mbyte	231 Mbyte, up to 260 Mbyte	502 Mbyte	240 Mbyte
Recommended R&S®SFx-B3 memory module (minimum)	1 Gbyte	1 Gbyte	256 Mbyte	512 Mbyte	256 Mbyte
Required hard disk space (approximately)	30 Gbyte	1.6 Gbyte	3.6 Gbyte	1 Gbyte	1.5 Gbyte
R&S®SFU	•	•	•	•	•
R&S®SFE	•	•	•	•	•
R&S®SFE100	•	•	•	•	•

[1] The additional arbitrary waveform generator options and the corresponding memory modules are a prerequisite for using the listed waveform libraries with the R&S®SFU, R&S®SFE and R&S®SFE100 broadcast signal generators.

[2] Corresponds to the Rohde&Schwarz format.

[3] Support of the waveform files depends on the installed hardware (memory depth). If there is not enough memory depth, it may not be possible to play any, or only a limited number, of the waveform files.

R&S®SFE100 test transmitter

The R&S®SFE100 is a powerful single-standard test transmitter for digital and analog TV and audio transmission standards. The R&S®SFE100-K35 arbitrary waveform generator supports the use of I/Q waveforms. It has been specially designed for applications in manufacturing and as a general-purpose solution for generating broadcasting signals, for example.

R&S®SFE100 test transmitter.

	Audio broadcasting		Broadcasting interferer		Analog broadcasting signals
	DRM	HD Radio™	Digital TV interferers	Cable interferers	Analog signals
	R&S®SFU-K353	R&S®SFU-K357	R&S®SFU-K354	R&S®SFU-K356	R&S®SFU-K360
	1.00	1.20	1.40	2.00	1.00
	.wv	.wv	.wv	.wv	.wv
	1.1 Mbyte, up to 329 Mbyte	2.1 Mbyte, up to 2 Gbyte	1 kbyte, up to 120 Mbyte	1 kbyte, up to 42 Mbyte	4 kbyte, up to 41 Mbyte
	512 Mbyte	2 Gbyte	128 Mbyte	64 Mbyte	64 Mbyte
	2.4 Gbyte	48 Gbyte	660 Mbyte	300 Mbyte	110 Mbyte
	•	•	•	•	•
	•	•	•	•	•
	•	•	•	•	•

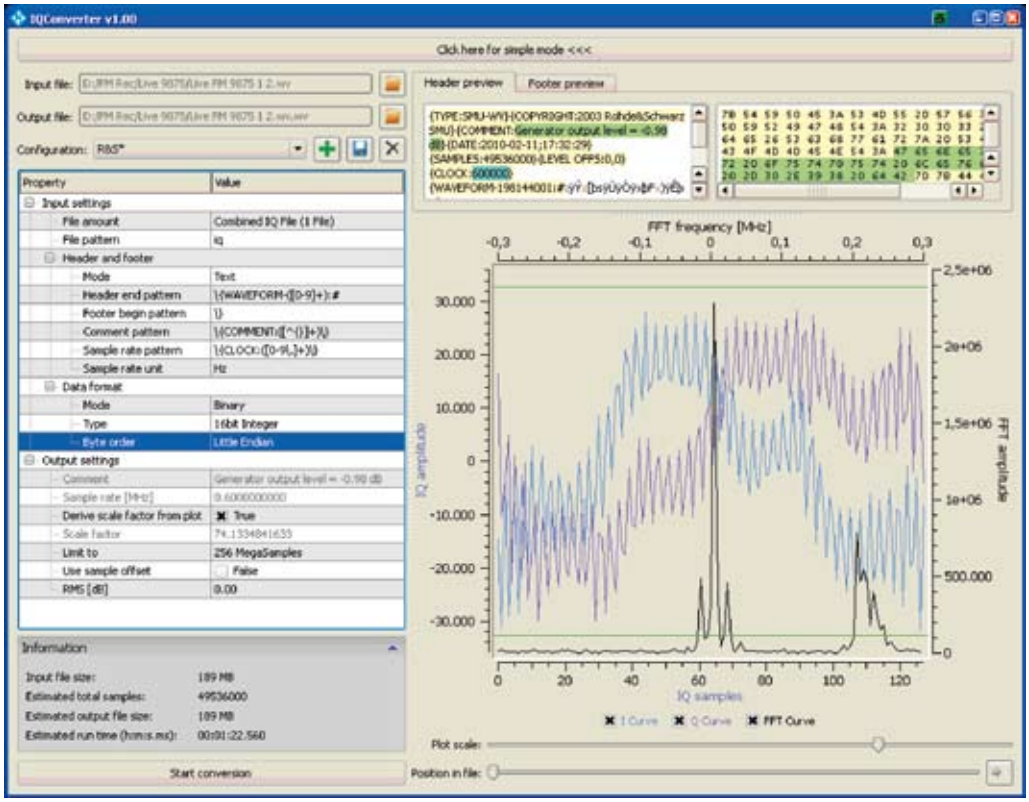
Intelligent software tools for generating signals

Especially in the case of broadcasting signals, and the video and audio signal content that is used, creating complex I/Q signals is time-consuming and requires intelligent tools. The software tools from Rohde&Schwarz meet these needs.

Waveform file conversion with the I/Q converter from Rohde&Schwarz

Any signal can be described using I/Q samples. Signals can either be sampled or synthetically generated using simulation software. When such I/Q waveform files are played back using an arbitrary waveform generator, the signals, their characteristics and the information content are analogically reconstructed. Since these files do not have a standardized structure, in practice many different formats are used.

The I/Q converter from Rohde&Schwarz is an intelligent tool with a powerful analysis function which can be used to quickly and conveniently transform the content of any structured, unknown waveform file into the waveform file format used by the R&S®SFU, R&S®SFE and R&S®SFE100 signal generators. It also supports I/Q data transfer from simulation programs such as MATLAB® in the waveform file format of the R&S®SFx family.



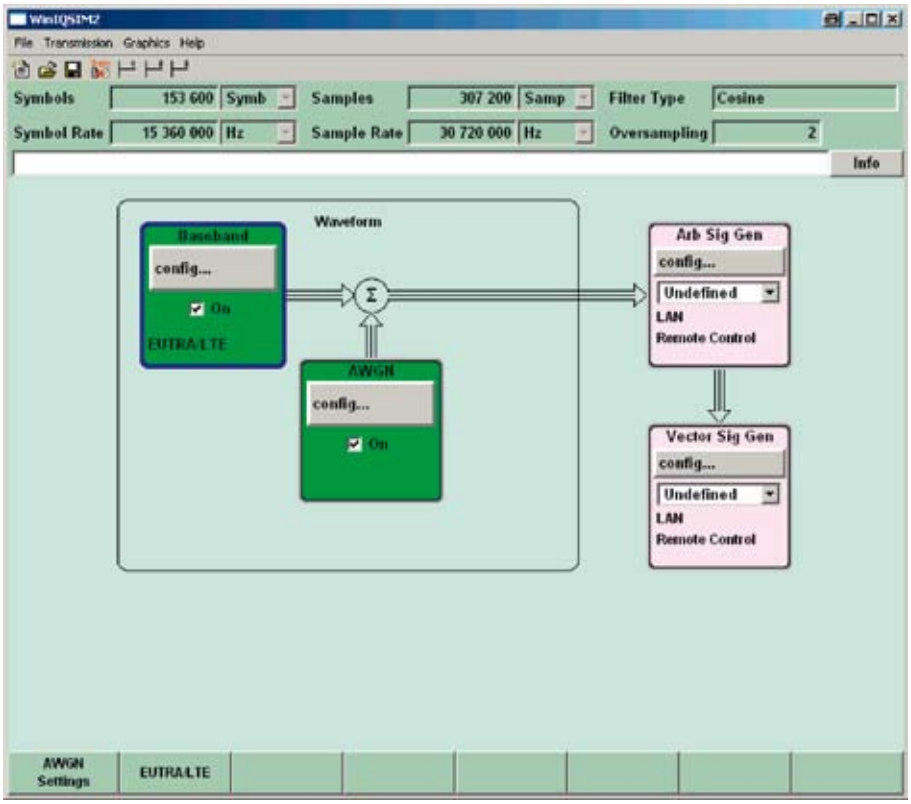
I/Q converter tool.

Wireless communications signal generation with R&S®WinIQSIM2™ software

The R&S®WinIQSIM2™ software supports the R&S®SFU in combination with its realtime coders. Using the R&S®SFU-K37 interferer management option, a wireless communications signal, generated with the R&S®WinIQSIM2™ software, can be added as interference. Wireless communications signals such as GSM, LTE and WiMAX™ can be generated with the R&S®WinIQSIM2™ software.

The digital dividend and the recent use of cut-off analog TV channel frequencies have given the combined simulation of broadcasting signals and wireless communications signals worldwide importance. In the freed-up frequency bands, wireless communications and terrestrial broadcasting frequencies lie very close to each other. In the case of cable transmission, the frequency bands used by terrestrial wireless communications and cable broadcasting actually overlap.

Therefore, new test strategies are needed to simulate potential mutual interference. The R&S®SFU broadcast test system's functionality can be used to simply and efficiently reproduce such scenarios – adjacent or overlapping wireless communications and broadcasting signals – and their effect. All wireless communications standards available in the R&S®WinIQSIM2™ software for the R&S®SFU broadcast test system are based on using the arbitrary waveform generator (R&S®SFU-K35 option).



R&S®WinIQSIM2™ simulation software.

Details common to all libraries

Documentation on the libraries

Comprehensive documentation on each waveform file makes working with the waveform libraries fast and effective. A description for each library is provided on CD-ROM or DVD.

Installation

All libraries are delivered on CD-ROM or DVD. All waveform files can be copied to the hard disk of the instrument from the CD-ROM or DVD that is included in the stream library option. The required hard disk space is specified in the table on pages 10 and 11. If the waveform library is ordered together with the base unit, the waveform files will be installed at the factory before delivery.

Activation

The waveform library options are activated via an instrument-specific key code, which is part of the delivery. The key code is valid for a specific instrument and tied to its serial number.

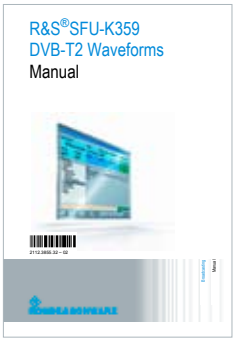
Updates

When libraries are enhanced, upgraded or changed, updates for the waveform libraries are available to registered customers free of charge and can be obtained from Rohde&Schwarz customer support.

Copyrights

The waveform files of the different libraries are protected by a Rohde&Schwarz license key. They can only be used with a Rohde&Schwarz arbitrary waveform generator if the related option is installed. Recording or copying these libraries for use with any other arbitrary waveform generator is not allowed.

Comprehensive documentation – example pages from the R&S®SFU-K359 manual


R&S®SFU-K359
DVB-T2 Waveforms
Manual

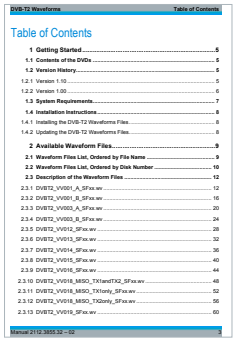
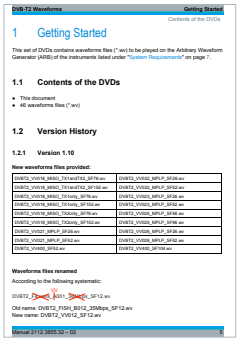
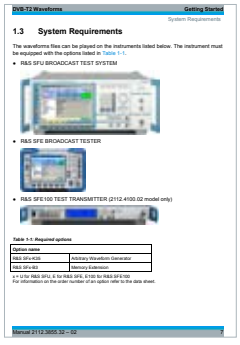

DVB-T2 Waveforms Table of Contents

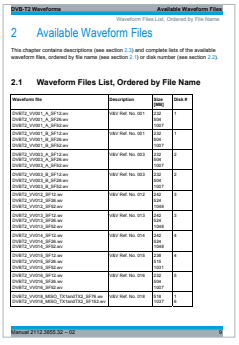
Table of Contents


DVB-T2 Waveforms Getting Started

1 Getting Started


DVB-T2 Waveforms Getting Started

1.3 System Requirements


DVB-T2 Waveforms Available Waveform Files

2 Available Waveform Files

Ordering information

To use the listed waveform libraries, either the R&S®SFU-K35, R&S®SFE-K35 or R&S®SFE100-K35 arbitrary generator option is required.

Designation	Type	Order No.
DVB-T2 Waveforms (can be used with R&S®SFx-K35)	R&S®SFU-K359	2112.3803.02
CMMB Waveforms (can be used with R&S®SFx-K35)	R&S®SFU-K358	2112.3726.02
MediaFLO™ Waveforms (can be used with R&S®SFx-K35)	R&S®SFU-K355	2110.2974.02
DVB-H Waveforms (can be used with R&S®SFx-K35)	R&S®SFU-K352	2110.4425.02
T-DMB/DAB Waveforms (can be used with R&S®SFx-K35)	R&S®SFU-K351	2110.4277.02
DRM Waveforms (can be used with R&S®SFx-K35)	R&S®SFU-K353	2110.4554.02
DRM+ Waveforms (can be used with R&S®SFx-K35)	R&S®SFU-K361	in preparation
HD Radio™ Waveforms (can be used with R&S®SFx-K35, iBiquity license required)	R&S®SFU-K357	only on request
Digital TV Interferers (can be used with R&S®SFx-K35)	R&S®SFU-K354	2110.4690.02
Cable Interferers (can be used with R&S®SFx-K35)	R&S®SFU-K356	2110.3212.02
Analog Signals (can be used with R&S®SFx-K35)	R&S®SFU-K360	2110.3941.02
Digital Standard GSM/EDGE (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K240	2115.2220.02
Digital Standard EDGE Evolution (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K241	2115.2237.02
Digital Standard 3GPP FDD (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K242	2115.2243.02
Digital Standard 3GPP Enhanced MS/BS Tests incl. HSDPA (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K243	2115.2250.02
Digital Standard GPS (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K244	2115.2266.02
Digital Standard 3GPP FDD HSUPA (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K245	2115.2272.02
Digital Standard CDMA2000® (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K246	2115.2289.02
Digital Standard 1xEV-DO Rev. A (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K247	2115.2295.02
Digital Standard IEEE 802.11 (a/b/g) (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K248	2115.2308.02
Digital Standard IEEE 802.16 (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K249	2115.2314.02
Digital Standard TD-SCDMA (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K250	2115.2320.02
Digital Standard TD-SCDMA Enhanced BS/MS Test (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K251	2115.2337.02
Digital Standard DVB-T/H (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K252	2115.2343.02
Digital Standard IEEE 802.11n (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K254	2115.2350.02
Digital Standard EUTRA/LTE (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K255	2115.2366.02
Digital Standard 3GPP FDD HSPA+ (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K259	2115.2372.02
Digital Standard Bluetooth® EDR (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K260	2115.2389.02
Multicarrier CW Signal Generation (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K261	2115.2395.02
AWGN (can be used with R&S®WinIQSIM2™, R&S®SFU-K35, R&S®SFU-K37, realtime coders R&S®SFU-K1 to R&S®SFU-K194)	R&S®SFU-K262	2115.2408.02

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