Test & Measurement

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Complimentary Reference Material

This PDF has been made available as a complimentary service for you to assist in evaluating this model for your testing requirements.

TMG offers a wide range of test equipment solutions, from renting short to long term, buying refurbished and purchasing new. Financing options, such as Financial Rental, and Leasing are also available on application.

TMG will assist if you are unsure whether this model will suit your requirements.

Call TMG if you need to organise repair and/or calibrate your unit.

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CERTIFIED MANAGEMENT SYSTEM

AIDN

Dual-Channel Arbitrary/Function Generator R&S® AM300

100 Msample/s
DC to 50 MHz

Smart Instruments™
R&S
The new product family
from
Rohde & Schwarz

First edition · February 2004

ROHDE&SCHWARZ

Dual-Channel Arbitrary/Function Generator Sampling rate 100 Msample/s

Top performance for arbitrary and standard signals

The R&S®AM300 is a dual-channel arbitrary/function generator that offers superb functionality and spectral purity at a favourable price. Due to its high-quality characteristics, the instrument displays digitally generated signals almost distortion-free – even at high output levels and frequencies. The R&S®AM300 thus meets reference signal source requirements for a host of applications.

With a high sampling rate of up to 100 Msample/s, 256k-point waveform memory per channel and the Waveform Composer software, virtually any waveform can be implemented – no matter whether for applications in the lab, in production or service.

The two channels of the instrument are phase-coupled and thus allow the generation of analog I/Q signals that can be used, for example, to modulate the RF Signal Generator R&S®SM300. The upper frequency limit of 35 Hz for sine signals and 50 MHz for square signals leaves sufficient room for future tasks.

Highlights

Two channels with individually selectable frequency, waveform and amplitude

Phase offset selectable with 0.01 ° resolution

Harmonic suppression for sine signals (1 MHz) typically 70 dB (0.03%)

Large colour display for displaying waveforms, including zoom function

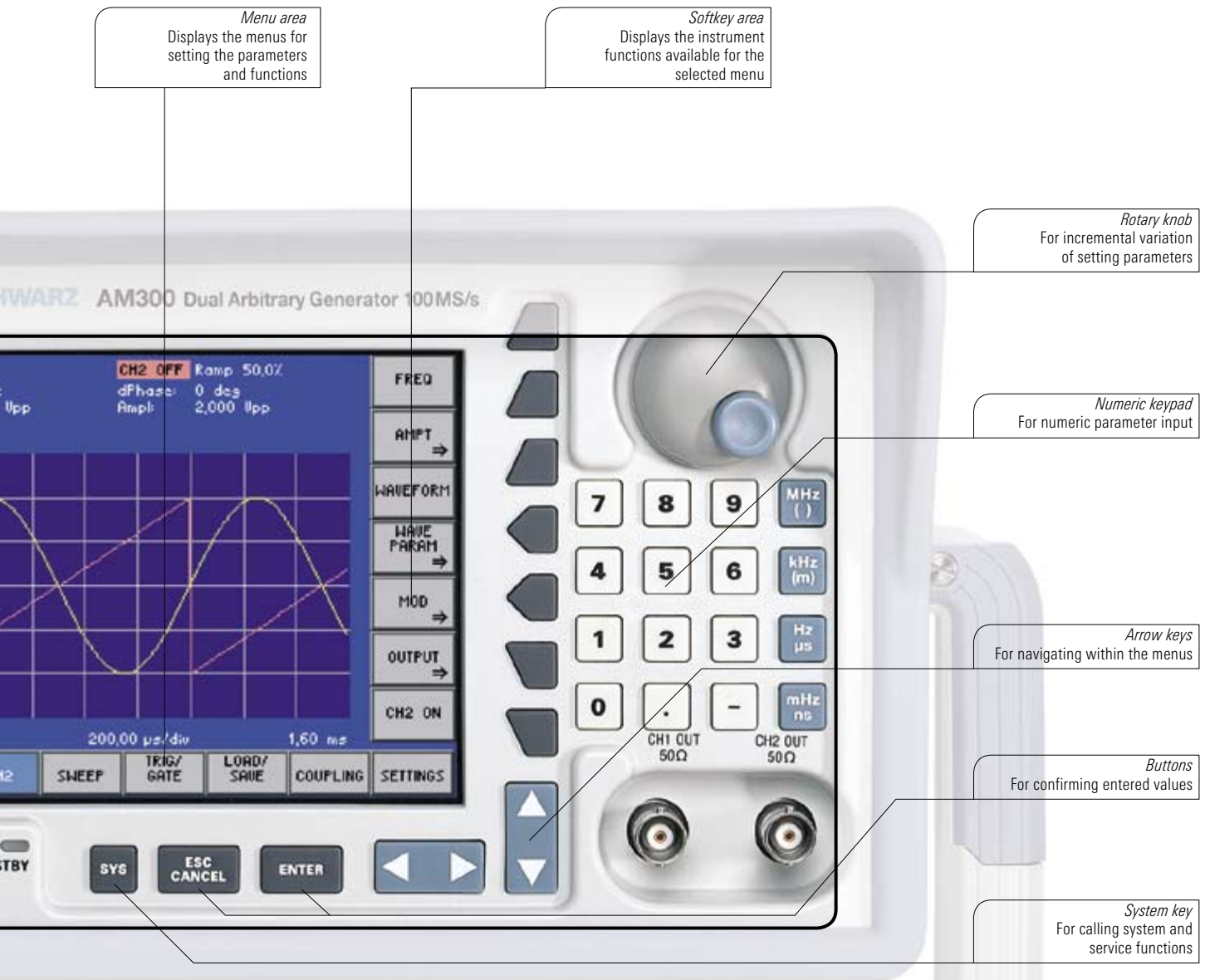**Highly stable reference frequency (1 ppm/year)**

Low-jitter clock generator up to 50 MHz

USB interface (with file management on USB stick)

Condensed data

Standard functions	sine, square, triangle, ramp, pulse, noise, exponential
Max. frequency ranges	35 MHz sine, 50 MHz square, 500 kHz for triangle, ramp and exponential
Modulation	AM, FM, φM, FSK, PSK
Arbitrary waveforms	100 Msample/s, 16 to 256k points per channel
Amplitude range	1 mV to 10 V (V_{pp}), with 14-bit resolution
Pulse	20 ns to 9999 s, selectable pulse width; rise time <10 ns
Sweep	linear and logarithmic
Trigger	1 trigger input, 2 sync outputs
Burst	1 to 65535 periods per burst

Menu area
Displays the menus for setting the parameters and functions

Softkey area
Displays the instrument functions available for the selected menu

Rotary knob
For incremental variation of setting parameters

Numeric keypad
For numeric parameter input

Arrow keys
For navigating within the menus

Buttons
For confirming entered values

System key
For calling system and service functions

CH2 OFF Ramp 50,0%
dPhase: 0 deg
Ampl: 2,000 Vpp

FREQ
AMPT →
WAVEFORM
WAVE PARAM →
MOD →
OUTPUT →
CH2 ON

200,00 µs/div   1,60 ms

SWEEP   TRIG/ GATE   LOAD/ SAVE   COUPLING   SETTINGS

HWARZ   AM300 Dual Arbitrary Generator 100 MS/s

7 8 9 MHz ( )
4 5 6 kHz (m)
1 2 3 Hz µs
0 . – mHz ns

CH1 OUT 50Ω   CH2 OUT 50Ω

SYS   ESC CANCEL   ENTER

Ergonomic user interface

Operation is menu-guided so that even untrained users will quickly obtain correct results. Clear structures simplify navigation within the menus.

The bright TFT colour display allows settings and results to be read even at odd angles or when the incidence of light is unfavourable.

Applications

The R&S®AM300 combines the functionality of three instruments:
arbitrary, function and I/Q generator.

Dual-channel function generator
Generation of a variety of standard functions such as sine or squarewave with modulation capability and precisely adjustable phase offset between the channels

Dual-channel arbitrary generator
Generation of virtually any type of waveform

I/Q baseband source
For digital transmission applications

Typical applications of the R&S®AM300

◆ High-quality modulation signal source

◆ Generation of two signals with precisely defined time and phase relationship

◆ Testing of control loops (e.g. AGCs)

◆ Generation of test signals, e.g. simulation of sensor signals including defined superimposed interference

◆ Replay of digitized data for reproduction of real signals

◆ I/Q modulation source for generating a wide range of digitally modulated broadband signals

◆ Generation of pulses and bursts

The possible combinations offered by the two channels of the R&S®AM300 further increase the instrument's versatility.

High-quality modulation signal source

Available modulation modes include AM, FM, φM, FSK and PSK. The desired signal can be selected from a variety of standard waveforms or defined by the user. Owing to its diverse modulation capabilities, the R&S®AM300 can be used in test labs, training centers and at universities as well as in R&D, service and production.

FM signal
Carrier: 6 MHz sine
Modulation: 10 kHz sine, 20 kHz deviation
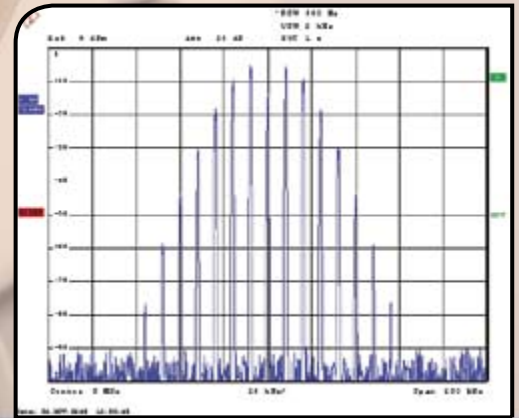
Precisely defined time and phase relationship

Generation of signals with defined time and phase relationship for testing the behaviour of detector circuits (e.g. phase detector).

Two sine waves
with 90 ° phase offset

Complex test signals

The comprehensive range of waveforms plus the capability of combining them with modulation and burst functionality allow signals for circuit testing to be generated. To test the transient response of automatic gain control (AGC) circuits, for example, level steps or defined ramps can be created conveniently. The R&S®AM300 meets all relevant requirements commonly encountered in electronics labs.

*Carrier: 35 MHz sine*
AM: negative ramp with 100 kHz
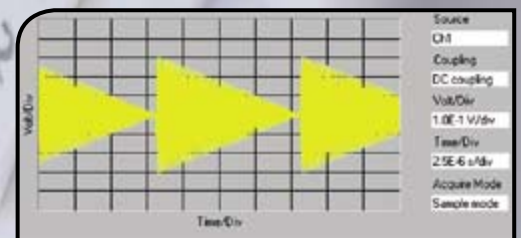
Arbitrary signals

Using the Waveform Composer software, you can generate nearly all conceivable waveforms. Plus, a large number of data formats can be imported and combined with user-defined signals. Waveform Composer also supports file formats such as used with oscilloscopes, for example. Synchronization to recorded signals can be supported by markers.

Arbitrary signal: 1000 points,
sampling rate 7.5 MHz
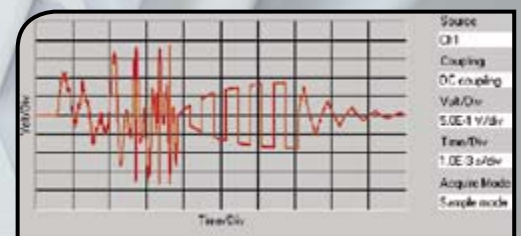
The R&S®AM300 can be used as an arbitrary, function or I/Q baseband generator
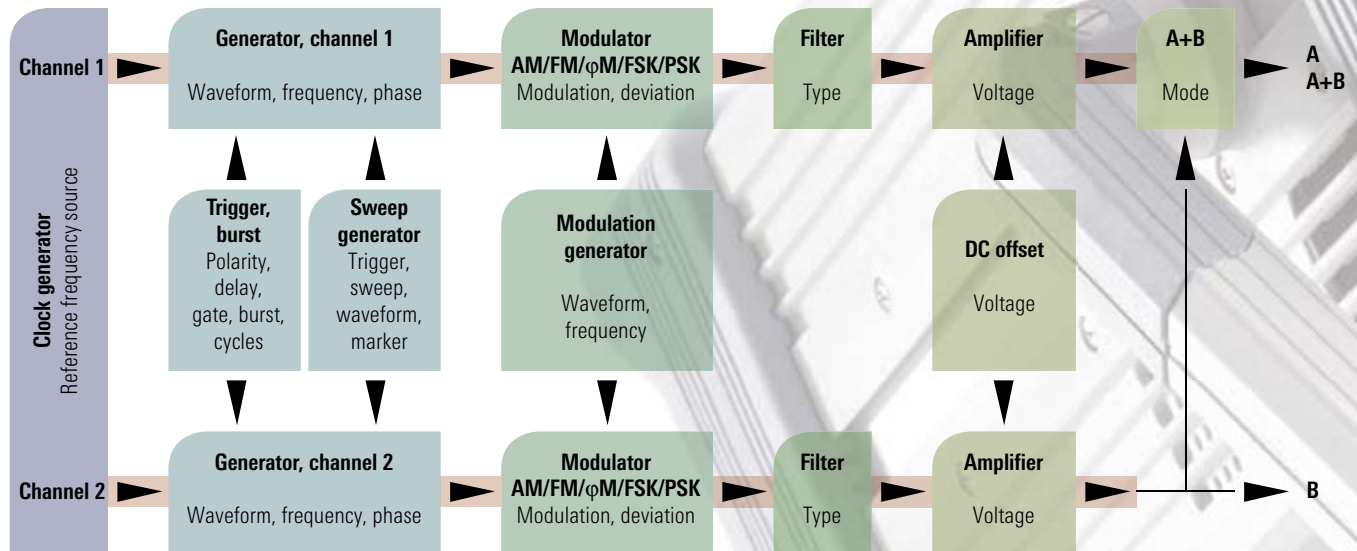
Function generator

Characteristics

- Two channels with separately selectable frequency, amplitude, waveform and phase
- Signals can be summed and output on one channel (addition)
- Variety of modulation modes

Advantages

- Two function generators in a single unit simplify test setups
- Precise, adjustable phase offset between the channels
- Creation of flexible test scenarios with individually selectable signal parameters, e.g. sine in channel 1 and noise with variable amplitude in channel 2

Arbitrary generator

Characteristics

- High signal quality
- Two channels with synchronous sampling
- Waveform Composer PC software for waveform generation
- Import filters for different waveform formats

Advantages

- True reproduction of digitally generated signals
- Generation of two-channel test scenarios with precisely defined time relationship
- Versatile applications based on PC software, e.g. replay of waveforms recorded with an oscilloscope
- High flexibility through user-programmable settings

I/Q source for digitally modulated signals

Characteristics

- Reading and replay of I/Q data
- Support of common mathematical programs such as Matlab or Mathcad

Advantages

- Use of the R&S®AM300 in digital transmission applications
- Economical I/Q baseband signal source, e.g. for training purposes

Wide range of modulation modes

The R&S®AM300 offers a variety of modulation options for waveform generation. Combinations of carrier waveform and modulation signal waveform as well as the modulation mode can be selected:

Carrier waveform	No modulation	AM	FM	φM	FSK	PSK
Sine	■	■	■	■	■	■
Triangle	■	■	■	■	■	■
Ramp	■	■	■	■	■	■
Square	■	■	■	■	■	■
Exponential	■	■	■	■	■	■
Noise	■					
Low-jitter square	■					
Pulse	■	■				
Arbitrary	■	■	■	■	■	■

Modulation signal waveform	AM	FM	φM	FSK	PSK
Sine	■	■	■		
Square	■	■	■	■*	■*
Triangle	■	■	■		
Ramp	■	■	■		
Negative ramp	■	■	■		
Exponential	■	■	■		
Noise	■	■	■		

■ *Supported with internal modulation source*

■* *Supported with internal or external modulation source*

The R&S® AM300 supports two operating modes

1. Coupled-frequency mode

◆ f1 = f2

◆ The two channels are phase-locked

◆ Modulation and sweep are supported

2. Decoupled-frequency mode

◆ The frequencies in the two channels can be separately set

◆ Modulation and sweep are not supported

Arbitrary waveform generation made easy – with Waveform Composer from Rohde & Schwarz

The optional Waveform Composer software makes it possible to generate and edit virtually any arbitrary waveform. The waveforms are displayed on screen while being created.

◆ Definition of waveforms by segments that may contain different components

◆ Linking of various waveforms (components) by addition, multiplication, division or subtraction

◆ Graphical, analytical (by mathematical expressions) or point-by-point waveform definition

◆ Simultaneous display of two different waveforms

◆ Import of numerous waveform formats

◆ Setting of markers to be issued at the sync outputs

◆ Comprehensive editing tools and zoom functions for waveform processing

File formats

The built-in import filters allow user-calculated waveforms to be loaded from other programs by means of Waveform Composer. The following formats are supported:

|			
ADS ASCII Single	*.asg	LeCroy	*.trc
ADS ASCII Mixed	*.asg	Mathcad Single	*.i, *.q
AM300 Binary	*.amb	Mathcad Mixed	*.dat
AM300 ASCII	*.ama	Matlab ASCII Single	*.dat
AWG 2000	*.wfm	Matlab ASCII Mixed	*.dat
COSSAP Single	*.i, *.q	Matlab Binary Single	*.mat
COSSAP Mixed	*.dat	Matlab Binary Mixed	*.mat
DAB-K1	*.sym	SPW ASCII Single	*.ascsig
DaDisp Single	*.i, *.q	SPW ASCII Mixed	*.ascsig
DaDisp Mixed	*.dsp	SPW Binary Mixed	*.sig
IQSIM	*.i, *.q	Uint16	*.i, *.q
IQW Mixed	*.iqw	WAV	*.wav

Simple downloading of waveforms via USB stick

In remote operation, waveforms generated with Waveform Composer can be loaded on the instrument via the USB cable. For mobile applications, up to 1000 waveforms can be stored on a USB stick (256 Mbyte) and downloaded from the instrument to the waveform memory when required.

Dual-Channel Arbitrary/Function Generator R&S®AM300

I/Q modulation with the R&S®AM300

The R&S®AM300 can replay I/Q data formats synchronously on the two channels and can therefore be used as an I/Q baseband generator for digital signals. Waveform Composer supports a wide range of I/Q data formats created by means of common mathematical development tools such as Matlab, Mathcad, etc. Using the RF Signal Generator R&S®SM300, the I/Q signals thus generated can be converted to a higher frequency.
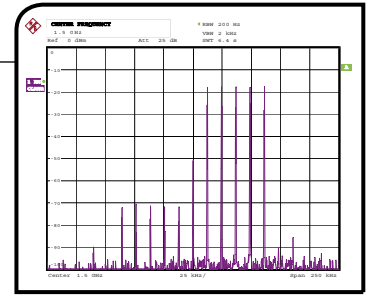
USB interfaces

The standard USB interface connects the instrument to the PC world. USB ensures high data transmission rates at low cost. Peripheral equipment, e.g. a printer or a USB memory stick, can also be addressed via a second USB interface.
Waveforms generated on a PC with Waveform Composer, for example, can easily be loaded on the instrument using a USB memory stick.

Identical housing

All instruments based on the Family 300 concept have an almost identical "face", including a 5.4-inch VGA TFT display, front-panel control elements, protective guards and a handle that can be adjusted to different positions. Only the connectors on the front and rear panels vary depending on the instrument type. If the protective guards and the handle are removed, the R&S®AM300 can be installed in a 19-inch rack. Owing to their slim design, two instruments of the Family 300 can be placed next to each other.

Uniform operating concept

All instruments of the Family 300 are similarly operated on the basis of the high-end devices from Rohde & Schwarz. Most operations are menu-controlled so that no device-specific keys are required. Only the four unit keys for confirming entered values are configured separately.

Specifications

Important: As a highly innovative company, we continuously refine our products. Please check our homepage www.smart.rohde-schwarz.com for new applications and features.

Channels

Number of channels	2
Phase	
Setting range	−180 ° to +180 °
Resolution	0.01 °
Operating modes	CH1, CH2, CH1+CH2

Waveforms

Standard	sine, triangle, ramp, square, pulse, exponential rise, exponential fall, noise
Arbitrary	
Waveform length	16 to 262144 (256k) points per channel
Level resolution	14 bit

Modulation

Modulation modes	AM, FM, φM, FSK, PSK

Frequency

Sine	10 µHz to 35 MHz
Triangle, ramp, square, exponential	10 µHz to 500 kHz
Low-jitter square[1]	10 µHz to 50 MHz
Noise	35 MHz bandwidth
Pulse	10 µHz to 16.667 MHz
Arbitrary	
Repetition rate	max. 6.25 MHz (16 points)
Sampling rate	10 µHz to 100 MHz
Resolution	10 µHz

Output parameters

Output voltage (into 50 Ω)	
Setting range	1 mV to 10 V (V_{pp}); with AM: 1 mV to 5 V (V_{pp})
Resolution	0.1 mV (4 digits)
Uncertainty	±2%
Frequency response (relative to 10 kHz sinewave)	
10 µHz ≤ f ≤ 30 MHz	±0.1 dB
30 MHz < f ≤ 35 MHz	±0.25 dB
Units	V (V_{pp}), dBm

Spectral purity (sinewave)

Harmonic distortion	<3 V (V_{pp})	≥3 V (V_{pp})	(output voltage)
20 Hz ≤ f ≤ 1 MHz	<–65 dBc	<–60 dBc	
1 MHz < f ≤ 5 MHz	<–55 dBc	<–55 dBc	
5 MHz < f ≤ 35 MHz	<–40 dBc	<–35 dBc	
Nonharmonic distortion			
10 µHz ≤ f ≤ 5 MHz	<–60 dBc	typ. (–70 dBc)	
5 MHz < f ≤ 25 MHz	<–45 dBc	typ. (–55 dBc)	
25 MHz < f ≤ 35 MHz	<–40 dBc	typ. (–50 dBc)	
SSB phase noise (10 kHz offset from carrier)			
10 MHz	–118 dBc (1 Hz)		
35 MHz	–117 dBc (1 Hz)		

Signal characteristics

Square	
Duty cycle	
≤500 kHz	1% to 99% (selectable)
10 µHz to 50 MHz	50% (fixed)
Rise/fall time	
10 µHz ≤ f ≤ 10 MHz	<10 ns
10 MHz < f ≤ 50 MHz	<5 ns
Overshoot	<5%
Pulse	
Period	70 ns to 9999 s
Pulse width	20 ns to 9999 s
Rise time	<10 ns
Overshoot	<5%
Ramp/triangle	
Symmetry	0% to 100%
Linearity	±0.1% (f < 10 kHz)
Exponential	
Type	rise or fall
Arbitrary	
Rise time	<10 ns
Linearity	±0.1% (f < 10 kHz)
Loading time via USB	16 s (binary, 256k points)

Output characteristics

DC offset (into 50 Ω)

Setting range	±5 V, |signal level + offset| ≤ 5 V
Uncertainty	±1% of setting ± 2 mV + 0.5% of signal level
Signal output	
Impedance	50 Ω nominal
Protection	short-circuit-protected
Filters	
Internal	
Operating modes	manual, automatic
Cutoff frequencies of lowpass filters	35 MHz, 37 MHz, 75 MHz
Filter types	9th order Bessel, 9th order Cauer
External filter connector	
Impedance (output and input)	50 Ω nominal
Output voltage	2 V (V_{pp})

Modulation[2]

AM	
Carrier waveforms	sine, triangle, ramp, square, exponential, pulse, arbitrary
Modulation waveforms	sine, square, triangle, ramp, exponential, noise
Modulation frequency	10 mHz to 100 kHz
Modulation depth	0% to 100%
Resolution	0.1%
Source	internal
FM	
Carrier waveforms	sine, triangle, ramp, square, exponential, arbitrary
Modulation waveforms	sine, square, triangle, ramp, exponential, noise
Modulation frequency	10 mHz to 100 kHz
Frequency deviation	100 mHz to 17.5 MHz
Source	internal
φM	
Carrier waveforms	sine, triangle, ramp, square, exponential, arbitrary
Modulation waveforms	sine, square, triangle, ramp, exponential, noise
Modulation frequency	10 mHz to 100 kHz
Phase deviation	−180 ° to +180 °
Source	internal
FSK	
Carrier waveforms	sine, triangle, ramp, square, exponential, arbitrary
Modulation waveform	square
Modulation frequency	0.1 mHz to 2 MHz
Frequency deviation	10 µHz to 500 kHz (sine: 35 MHz)
Source	internal, external
PSK	
Carrier waveforms	sine, triangle, ramp, square, exponential, arbitrary
Modulation waveform	square
Modulation frequency	0.1 mHz to 2 MHz
Phase deviation	−180 ° to + 180 °
Source	internal, external

Gate/burst

Waveforms	sine, triangle, ramp, square, exponential, arbitrary
Gate settings	block end, sample & hold, burst
Number of cycles per burst	1 to 65535
Start phase	−180 ° to +180 °
Gate length (internal)	100 ns to 9999 s
Gate source	internal, external

Sweep

Waveforms	sine, triangle, ramp, square, exponential, arbitrary
Type	linear, logarithmic
Direction	upward
Start/stop frequency	10 mHz to max. signal frequency (sine: 35 MHz)
Sweep time	1 ms to 999 s
Marker	frequency marker

Trigger

Source	manual, internal, external
Delay	
Setting range	0 ns or 150 ns to 9999 s
Resolution	10 ns
Internal trigger	
Repetition cycle	500 ns to 9901 s (2 MHz to 101 µHz)
Resolution	10 ns
External trigger input	
Input voltage	TTL-compatible
Edge	rising or falling, selectable
Pulse width	>100 ns
Input impedance	>1 kΩ (DC-coupled)
Latency (burst, sweep)	typ. 100 ns
Sync outputs	
Number of outputs	2
Voltage	TTL-compatible
Pulse width	≥50 ns
Polarity	selectable
Impedance	50 Ω
Sources	comparator, phase accumulators, marker, triggers

Reference

Reference oscillator (internal)	
Frequency	10 MHz
Stability	<1 ppm
Aging	<1 ppm/year
Reference input	
Frequency	10 MHz, 5 MHz, 2 MHz
Frequency error	$<5 \times 10^{-6}$
Input voltage	0.5 V to 2 V (50 Ω)
Input impedance	50 Ω
Reference output	
Frequency	10 MHz
Output voltage	>0.5 V (50 Ω)
Impedance	50 Ω

Interfaces

USB host	
Connector	B plug
Protocol	version 1.1
Command set	device-specific, remote control
USB device	
Connector	A plug
Protocol	version 1.1
Additional memory	USB memory stick[3]

Power supply

Input voltage range	100 V to 240 V AC (autoranging), 50 Hz to 60 Hz
Power consumption	<35 VA

[1] Sampling on edge of square, therefore low jitter, fixed duty cycle of 50%.

[2] Modulation possible only in coupled-frequency mode, i.e. frequency CH1 = frequency CH2.

[3] Not supplied as standard.

General data

Display	
Type	5.4" active colour TFT display
Number of pixels	320 x 240
Memory locations	
Device setups	8
Ambient conditions	
Operating temperature range	+5 °C to +45 °C, meets DIN EN 60068-2-1/2
Storage temperature range	−20 °C to +70 °C
Relative humidity	95% at +40 °C, meets DIN EN 60068-2-3 (no moisture condensation)
Mechanical resistance	
Vibration, sinusoidal	5 Hz to 150 Hz, max. 2 g at 55 Hz, meets DIN EN 60068-2-6;
	55 Hz to 150 Hz, 0.5 g constant, meets DIN EN 61010-1 and MIL-T-28800D class 5
Vibration, random	10 Hz to 500 Hz, 1.9 g, meets DIN EN 60068-2-64
Shock	shock spectrum, meets DIN EN 60068-2-27 and MIL-STD-810
Electromagnetic compatibility	meets EN 55011 class B and EN 61326 (EMC Directive 89/336/EEC)
EMI field strength	<10 V/m
Protection class	DIN EN 61010-1 / IEC61010-1 UL3111-1; CSA22.2 No:1010.1
Dimensions (W x H x D)	219 mm x 147 mm x 350 mm
Weight	6.2 kg

Ordering information

Dual-Channel Arbitrary/Function Generator R&S®AM300

Designation	Type	Order No.
Dual-Channel Arbitrary/Function Generator		
(including PC software R&S®AM300-K1)	R&S®AM300	1147.1998.03
Waveform Composer (software, licensed for 5 instruments)	R&S®AM300-K2	1147.2013.02
Rack Adapter	R&S®ZZA-300	1147.1281.00

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