

# R&S® BBA300 BROADBAND AMPLIFIER

High power and exceptional RF performance  
over an ultrawide frequency band



Product Brochure  
Version 03.01

**ROHDE & SCHWARZ**

Make ideas real



# AT A GLANCE

The R&S®BBA300 broadband amplifiers are a new generation of compact solid-state broadband amplifiers designed for high availability. They feature extremely wide, continuous frequency bands extending into the upper microwave range along with high linearity, outstanding noise power density, a low noise figure and excellent harmonic characteristics. They also have highly flexible system configurations and operational settings.

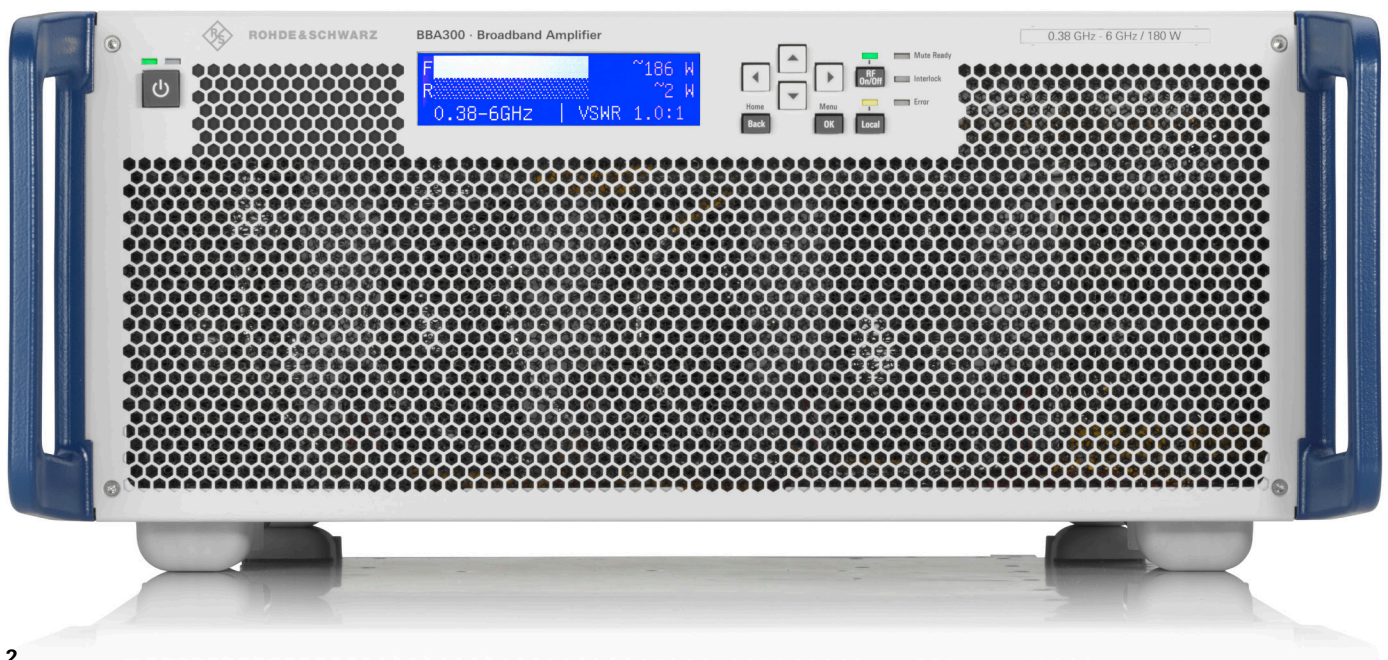
The solid-state R&S®BBA300 broadband amplifiers combine the outstanding characteristics of the well-known R&S®BBA130 and R&S®BBA150 amplifier families with higher availability, larger bandwidths and higher frequencies. The new, modular mechanical design allows versatile scaling of R&S®BBA300 broadband amplifiers. The frequency ranges and power levels can also be expanded.

The modern software platform provides a positive user experience with a web GUI or a 10" touchscreen that supports role based operations and functional extensions that can be enabled as needed. The bias point can be adjusted between class A and class AB during operations for higher efficiency. Additional RF power can be enabled with good matching at the RF output.

The R&S®BBA300-CDE and R&S®BBA300-DE are the first amplifier series in the R&S®BBA300 product family.

The R&S®BBA300-CDE amplifier series have an ultra-broad continuous frequency band from 380 MHz to 6 GHz that covers the entire range for GSM, LTE, 5G and GPRS mobile communications frequencies as well as the frequencies for the WLAN, Bluetooth® and Zigbee wireless standards. The series supports a wide variety of applications and can withstand reflections and mismatch, making it ideal for radiated electromagnetic susceptibility (EMS) test setups. Potential applications include the development of passive RF components for mobile devices and base stations. R&S®BBA300-CDE amplifiers can be used in passive intermodulation (PIM) testing to validate and specify RF components. PIM testing requires broadband, linear RF amplifiers.

The R&S®BBA300-DE amplifier series is a cost-effective solution for standard EMS applications between 1 GHz and 6 GHz.



# KEY FACTS

- ▶ Continuous RF signal sweeps across ultrabroad frequency ranges up to 6 GHz
- ▶ Linear RF output power up to 300 W with outstanding noise power density, a low noise figure and excellent harmonic characteristics
- ▶ Supports amplitude, frequency, phase, pulse and complex OFDM modulation modes
- ▶ Resistant to mismatch at RF output
- ▶ High availability thanks to smart protection concepts, even in the event of transistor failures
- ▶ Smart – thanks to versatile settings and key-enabled functions
- ▶ Flexible and scalable functions and configuration, expandable frequency range and power

# BENEFITS

Ultrabroad frequency band

▶ [page 4](#)

One amplifier, many applications

▶ [page 6](#)

Compact, scalable, flexible

▶ [page 8](#)

Reliability and high availability

▶ [page 9](#)

## Rohde & Schwarz broadband amplifiers – model overview

1 dB compression point (P1dB)

10000 W

3000 W

2500 W

800 W

600 W

400 W

300 W

125 W

79 W

30 W

15 W

Frequency

4

9 kHz

80 MHz

250 MHz

400 MHz

690 MHz

1 GHz

2.5 GHz

3.2 GHz

6 GHz

□ R&S®BBL200 (band A)

□ R&S®BBA150 (band A)

□ R&S®BBA130/R&S®BBA150 (band BC)

□ R&S®BBA130/R&S®BBA150 (band D)

□ R&S®BBA130/R&S®BBA150 (band E)

□ R&S®BBA150 (band AB)

□ R&S®BBA300 (band CDE/DE)

P1dB power classes

3/5/10 kW

125/160/200/400/700 W, 1.3/2.5 kW

70/125/160/250/500 W, 1/1.25/1.5/2/3/5/7.5/10 kW

30/60/110/200/400/800 W

15/30/60/100/200/400 W

75/125/160/200/350/600 W

15/25/50/90/180/300 W



# ULTRABROAD FREQUENCY BAND

- ▶ Broadband amplification with output power up to 300 W in the following bands:
  - 380 MHz to 6 GHz (R&S®BBA300-CDE amplifier series)
  - 1 GHz to 6 GHz (R&S®BBA300-DE amplifier series)
- ▶ Continuous RF signal sweeps across the entire frequency band
- ▶ High linearity, outstanding noise power density, a low noise figure and excellent harmonic characteristics
- ▶ Supports amplitude, frequency, phase, pulse and complex OFDM modulation modes

R&S®BBA300-CDE and R&S®BBA300-DE amplifiers provide broadband amplification in the frequency ranges from 380 MHz to 6 GHz (R&S®BBA300-CDE) and 1 GHz to 6 GHz (R&S®BBA300-DE) with output power up to 300 W.

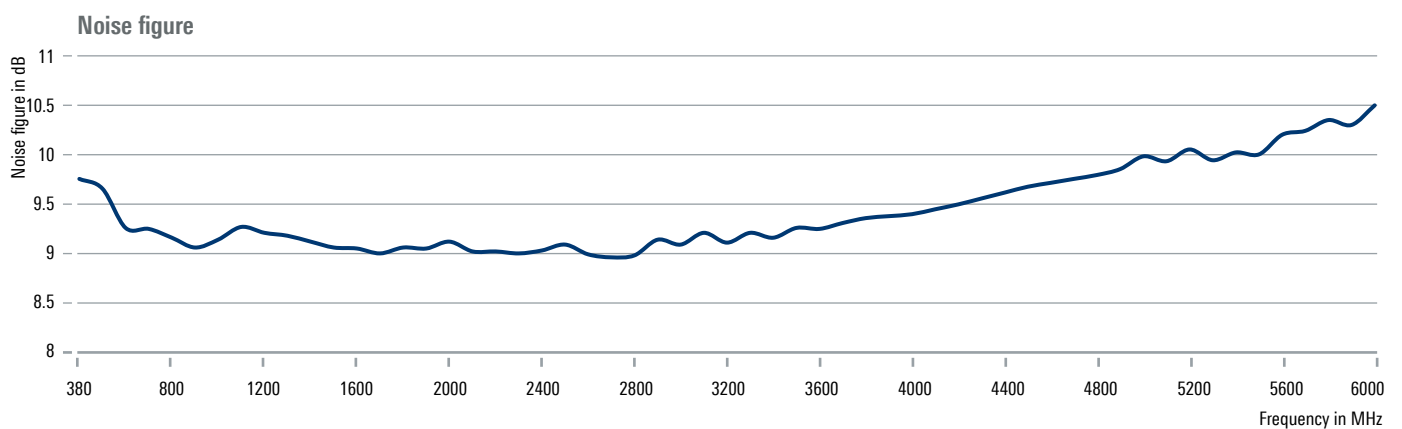
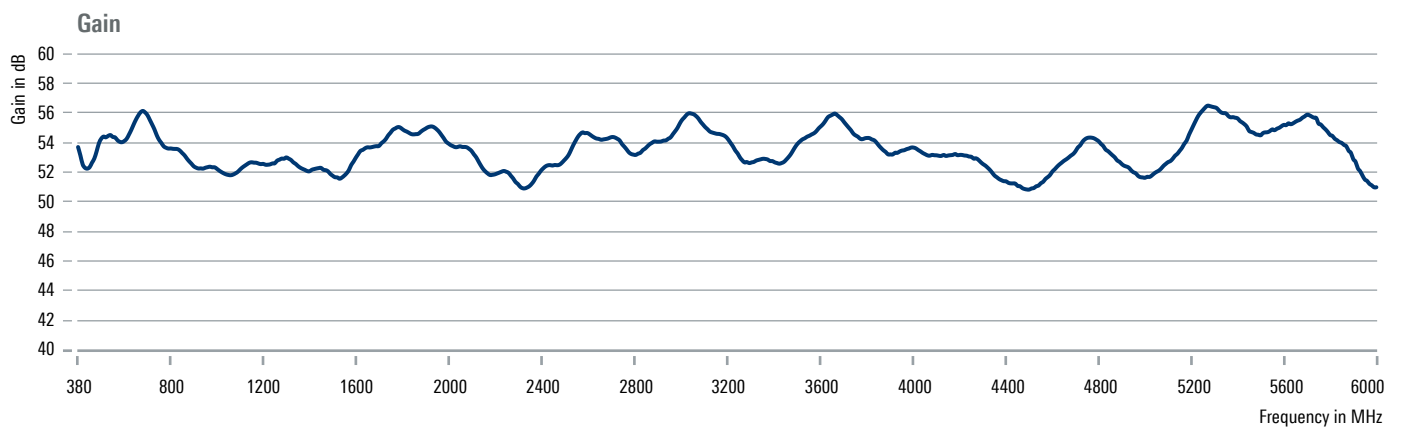
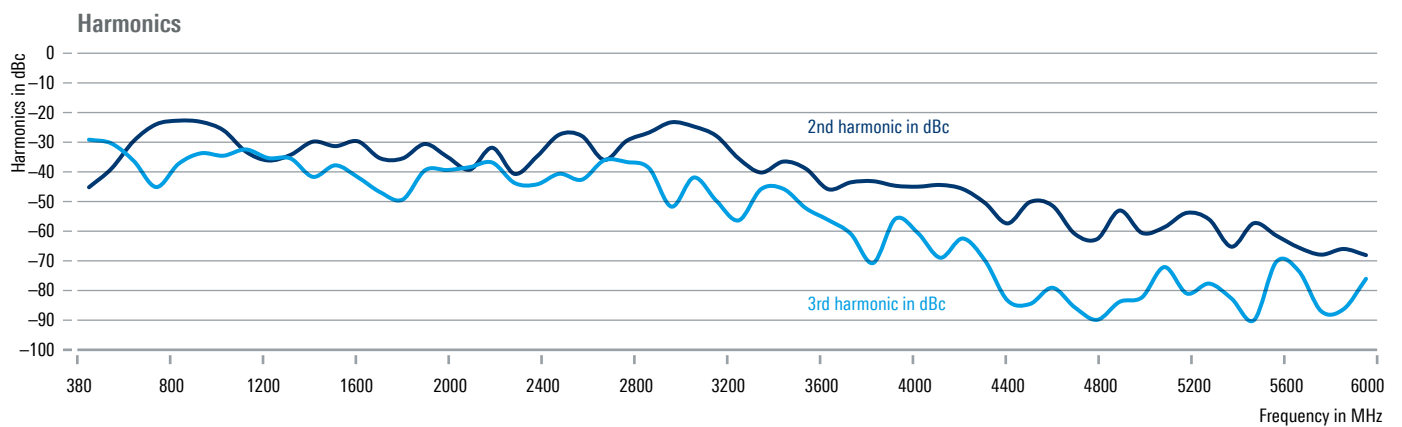
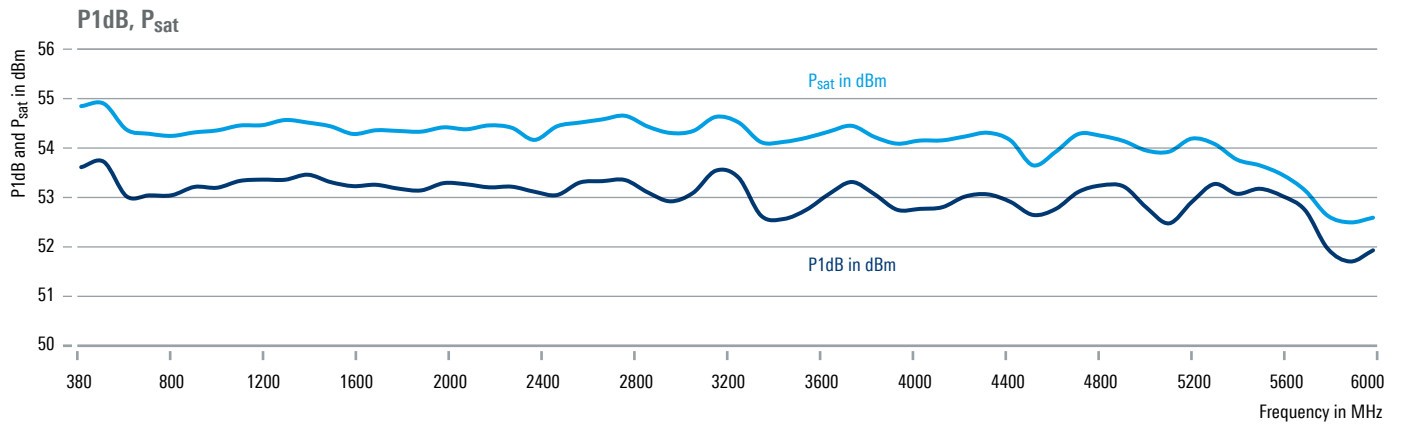
The amplifiers help continuously sweep the RF signal across the entire frequency range, speeding up RF component and device testing and validation for manufacturers in the wireless communications industry. Narrowband CW signals, signals with simple AM, FM, PM or  $\phi$ M modulations, and broadband, complex OFDM signals with 200 MHz bandwidth, can be amplified. The two amplifier series support GSM, LTE, 5G and GPRS mobile communications frequencies as well as testing of the WLAN, Bluetooth® and Zigbee wireless standards.

High linearity, outstanding noise power density as low as  $-110$  dBm/Hz, a noise figure of 10 dB and harmonic characteristics of  $-25$  dBc or better ensure a low adjacent channel leakage ratio (ACLR) and excellent transfer characteristics without increasing the error vector magnitude (EVM). These properties enable the coexistence of different radio standards as well as transmission and reception in adjacent channels carrying complex OFDM signals and do not need any additional components such as filters.



Amplifier system consisting of 1 × R&S®BBA300 and 3 × R&S®BBA150 deployed in radiated electromagnetic susceptibility tests from 4 kHz to 6 GHz.

## Amplifier performance measurements (R&S®BBA300-CDE180)



# ONE AMPLIFIER, MANY APPLICATIONS

- ▶ Advanced, role based operating concept with key-enabled optional functions
- ▶ Amplifier RF transfer function adaptable to required application
- ▶ State-of-the-art control and operation

## Smart control – grows with your requirements

R&S®BBA300 broadband amplifiers now have a new control and monitoring software platform. Different roles can be defined with tiered configuration and operation privileges. Dedicated access to comprehensive parameter sets can be granted. The new operating concept, supported by an optional 10" touchscreen (R&S®BBA-B200), provides a unique user experience for straightforward operation on site or remote access via a web GUI. Test sequences can be automated using remote control SCPI commands over a standard Ethernet interface. The SNMP protocol enables remote control. The modular software structure enables scalability of the R&S®BBA300 broadband amplifier functional range. Building on base functions, users can add functions as needed with a keycode.

## Setting the bias point and high power with the R&S®BBA300-PK1 software option

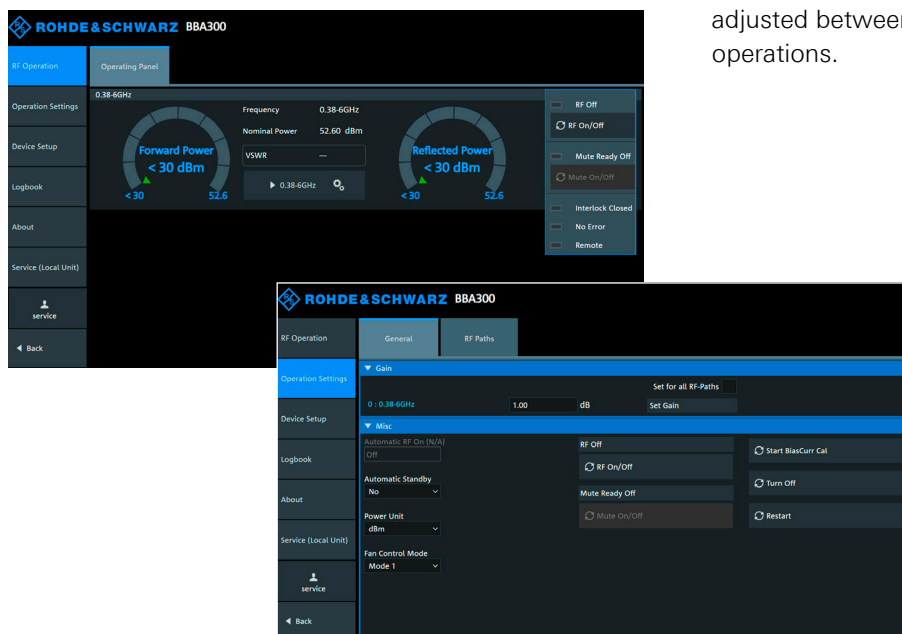
The R&S®BBA300 is ideal for a large variety of applications, including EMS measurements, development and product validation testing and power sensor calibration. Deployments in particle accelerators, medical research, scientific research or plasma applications are also possible. Each requires different amplifier characteristics.

The R&S®BBA300-PK1 software option has two powerful tools to optimize output signals: bias point adjustment between class A and class AB, and giving users a choice between maximum output power or mismatch tolerance. Both help optimize the output signal and respond flexibly to a wide range of requirements. The parameters can also be modified while the amplifier is in operation.

## Adjusting the bias point

The bias point defines how an amplifier is operated and has a major influence on the signal transfer within the amplifier. If the bias point is in the middle of the transistor's linear region, it acts as a class A amplifier. Class A bias points combine excellent linearity with very good harmonic performance. Adjusting the bias point to class AB amplifier enables the faithful reproduction of pulsed signals and improves efficiency.

When a clean CW signal is needed to test a DUT, the R&S®BBA300 is operated in class A. To accurately amplify pulsed signals, the bias point is adjusted to class AB. Depending on the requirements, the bias point can be adjusted between class A and class AB in ten steps during operations.



The straightforward web GUI makes operating R&S®BBA300 broadband amplifiers easy.

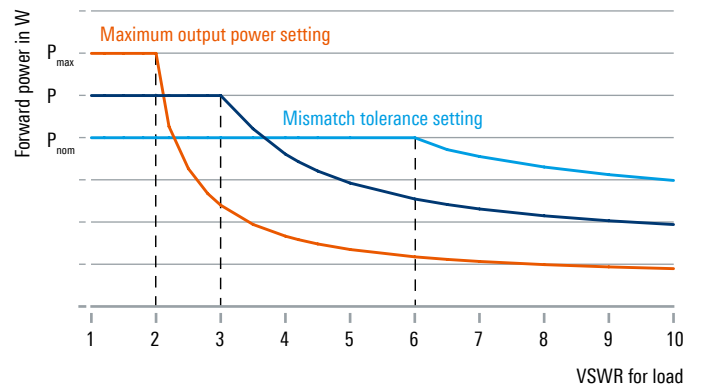
### Maximum output power or high mismatch tolerance

Amplifiers can be used for a number of different applications. Depending on the requirements, the R&S®BBA300-PK1 software option allows the R&S®BBA300 to be operated between high maximum output power with good matching on the RF output (max. voltage standing wave ratio (VSWR) ≈ 2:1) and high mismatch tolerance with delayed power reduction (starting at VSWR ≈ 6:1).

Impedance matching at the amplifier output is usually good for design and product validation testing when good matching is needed for DUTs with 50 Ω systems or when inserting a circulator between the amplifier and the DUT. The installed amplifier power margin is then fully used. Mismatch can only result from a faulty DUT or circulator. The amplifier can lower power levels because it only has to protect itself.

EMC applications with poorly matched antennas or DUT measurements with input impedance deviating significantly from 50 Ω use the amplifier to produce the desired output power for as long as possible. The amplifier cannot reduce power levels to protect itself (unless there is a very large mismatch).

### Maximum output power versus higher mismatch tolerance



### Amplifier characteristics for various control parameter settings and typical applications

	Class AB ▶ Faithful reproduction of a pulsed signal ▶ Good efficiency	Class A ▶ High linearity ▶ High spectral purity
<b>High power</b> ▶ Signals with high crest factor ▶ Good matching required at amplifier output	<b>Design and product validation tests</b> ▶ Tests with pulsed signals ▶ Slam testing ▶ Ruggedness test ▶ Artificial aging	<b>Design and product validation tests</b> ▶ Intermodulation tests, e.g. PIM tests ▶ Multitone tests ▶ Peak-to-average ratio tests
<b>High mismatch tolerance</b> ▶ Poor matching possible at amplifier output	<b>Various tests</b> ▶ Maximum output power dependent on amplitude and phase of mismatch	<b>EMC testing</b> ▶ Poor matching of antenna or current probe, reflections from DUT and/or EMC chamber  <b>Scientific applications</b> ▶ Linear broadband amplifiers

# COMPACT, SCALABLE, FLEXIBLE

- ▶ Compact, modular design
- ▶ Extensive switch options for flexible system configuration
- ▶ Expandable frequency range and power

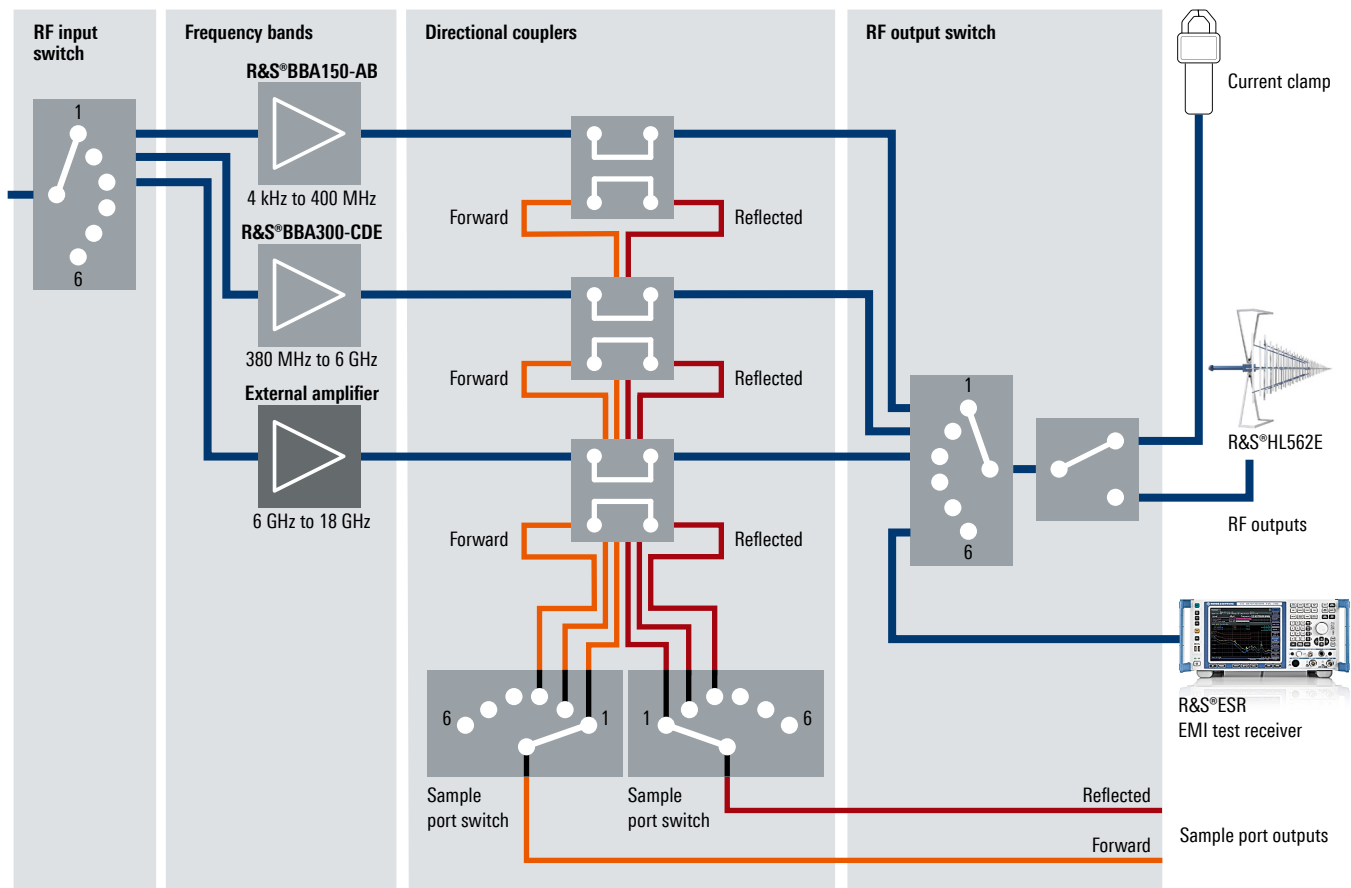
The R&S®BBA300 broadband amplifiers provide very high RF power levels and ultrabroad bandwidth in a very small package, which would normally require a far more complex design. The R&S®BBA300-CDE180 enables power densities of 180 W P1dB in just four height units.

The design is optimized for the greatest possible flexibility in a small footprint. The compact and modular design of the amplifiers and other components enable scalable, highly integrated rack systems with 19" plug-in units. Amplifier frequency range and power can be flexibly configured and extended at any time, making for a safe investment.

R&S®BBA300 broadband amplifiers can be integrated into existing, flexible, tried-and-tested Rohde&Schwarz amplifier system configurations that are already established on the market. Rohde&Schwarz also has a wide range of switching and system solutions.

Switching options make it possible to combine individual amplifiers for a specific application, while allowing multiple frequency bands to be grouped into a system. R&S®BBA300 broadband amplifiers are fully compatible with R&S®BBA130 and R&S®BBA150 broadband amplifiers for other frequency ranges.

## Multiband amplifier system from 4 kHz to 18 GHz with switching options





# RELIABILITY AND HIGH AVAILABILITY

- ▶ Rohde & Schwarz has decades of experience with developing reliable amplifiers
- ▶ High system availability
- ▶ Custom service packages

The innovative R&S®BBA300 family is both highly available and reliable. The sophisticated RF design ensures dependable, continuous operations even with a mismatched load on an RF output or a shorted or open RF output. EMC labs appreciate the high mismatch tolerance of Rohde & Schwarz broadband amplifiers, since they can still provide full RF forward power at the output even with a VSWR as high as 6:1.

Minimizing downtime is vital for users and Rohde & Schwarz amplifiers have high availability, stability and reliability. Innovative, smart protection concepts enable operation at reduced power levels or even when a transistor fails and the amplifiers can even continue performing applications with lower power demands. Other functions such as periodic bias current adjustment can compensate for component aging and drift as they increase over the lifetime of a broadband amplifier.

Rohde & Schwarz customized service further enhances the high R&S®BBA300 amplifier system availability. They provide quick support for maximum investment protection. The amplifiers are backed up by extensive logging functions, spare parts stocks, loaner equipment, on-site service and regular maintenance. R&S®BBA300 amplifiers have continuous and reliable operational readiness, while remaining highly available throughout their lifetimes.

## Service level overview

Maintenance and support services	Basic	Customized	Premium	Premium
			Desktop units	Rack systems
Rohde & Schwarz Support Center: problem reporting and overview/tracking of customer requests	●	●	●	●
Repair service at factory or service center				
Prioritized, with fixed turnaround time (TAT), within 9 working days <sup>1)</sup>	–	○	●	–
Standard, with no defined TAT	●	●	●	●
On-site service <sup>1)</sup>				
Fast, start of work within 2 working days	–	○	–	●
On demand, without assured times	–	○	–	●
Parts for fast repair <sup>1)</sup>	–	○	●	●
Technical support during business hours				
Fast, response to critical incidents within 2 hours	–	○	●	●
Standard, response to critical incidents within 6 hours	–	○	–	–
Firmware/software updates	–	○	●	●
Regular product maintenance at Rohde & Schwarz or on site <sup>1)</sup>	–	○	●	●
Regular review meeting, once per year	–	○	●	●

<sup>1)</sup> According to regional availability.

● Included in service level.

○ Selectable in service level.

# SPECIFICATIONS IN BRIEF

## Specifications in brief

### RF specifications

Frequency range		
R&S®BBA300-CDE	continuous	380 MHz to 6 GHz
R&S®BBA300-DE	continuous	1 GHz to 6 GHz
Nominal output power	380 MHz to 6 GHz	15 W to 300 W
	1 GHz to 6 GHz	15 W to 300 W
Nominal output impedance		50 Ω
Gain flatness		±3.5 dB or better (see specifications document)
Gain adjustment range		> 15 dB
Bias point		class A
	optional	adjustable, class A through class AB
Forward output power	voltage standing wave ratio (VSWR) < 6:1	nominal output power
	voltage standing wave ratio (VSWR) > 6:1	continuous reduction down to 50% of nominal output power at total reflection
	optional	adjustable from VSWR of 2:1 in high power mode to VSWR of 6:1 in VSWR mode
Output mismatch protection, VSWR		100%, without damage
Modulation capability		AM, FM, PM, φM, OFDM
Harmonics	at P1dB output power	-20 dBc or better
Noise figure	at maximum gain	10 dB
Noise power density		-110 dBm (1 Hz)
Input level for nominal output power		0 dBm
Nominal input impedance		50 Ω

### RF and sample ports

RF input port		N female
RF output port		N female
RF sample ports		N female
DC sample ports		N female

### Graphical user interface

Local display		200 × 48 pixel, monochrome
Web GUI	via Ethernet	RJ-45, 10/100/1000 Mbit/s, half/full duplex, autonegotiation
Touchscreen for system control	optional, for rack systems	10" color touchscreen

### Remote control

Ethernet		RJ-45, 10/100/1000 Mbit/s, half/full duplex, autonegotiation
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### Protection

Load VSWR		infinite
Interlocks		1 automatic interlock, 1 interactive interlock
Input protection against bias voltage	optional	DC blocking level ≤ 50 V DC
Thermal overload		shutdown in case of thermal overload

### General data

Air cooling		forced cooling, built-in fans, air intake on the front, air outlet on the rear
Dimensions	W × H × D	
Desktop models	incl. fans, handles and feet	430 mm × 196 mm × 580 mm (16.93 in × 7.72 in × 22.83 in)
	For integration in racks	
	15/25/50/90/180 W model	19" 1/1, 4 HU
	300 W model	19" 1/1, 12 HU

All specified parameters are valid for an ambient temperature of +25 °C, input impedance of 50 Ω and output impedance of 50 Ω.

# ORDERING INFORMATION

Designation	Type	Configuration No./Order No.
<b>Base units</b>		
<b>Broadband amplifier, frequency band from 380 MHz to 6 GHz</b>		
15 W, air-cooled, 4 HU, desktop model	R&S®BBA300	BBA300-CDE15
25 W, air-cooled, 4 HU, desktop model	R&S®BBA300	BBA300-CDE25
50 W, air-cooled, 4 HU, desktop model	R&S®BBA300	BBA300-CDE50
90 W, air-cooled, 4 HU, desktop model	R&S®BBA300	BBA300-CDE90
180 W, air-cooled, 4 HU, desktop model	R&S®BBA300	BBA300-CDE180
300 W, air-cooled, 12 HU, rack model	R&S®BBA300	BBA300-CDE300
<b>Broadband amplifier, frequency band from 1 GHz to 6 GHz</b>		
15 W, air-cooled, 4 HU, desktop model	R&S®BBA300	BBA300-DE15
25 W, air-cooled, 4 HU, desktop model	R&S®BBA300	BBA300-DE25
50 W, air-cooled, 4 HU, desktop model	R&S®BBA300	BBA300-DE50
90 W, air-cooled, 4 HU, desktop model	R&S®BBA300	BBA300-DE90
180 W, air-cooled, 4 HU, desktop model	R&S®BBA300	BBA300-DE180
300 W, air-cooled, 12 HU, rack model	R&S®BBA300	BBA300-DE300
<b>Options</b>		
<b>Hardware options</b>		
GPIO remote control	R&S®BBA-B101	5355.8250.02 <sup>1)</sup>
PoE switch	R&S®BBA-B102	5355.8243.30
Optical Ethernet remote control	R&S®BBA-B105	5355.8266.13
RF input switch (1:2 or 2:1, N)	R&S®BBA-B110	5355.8866.17 <sup>1)</sup>
RF input switch (1:6, N)	R&S®BBA-B116	5355.8950.12
RF output switch (2:1 or 1:2, N)	R&S®BBA-B120	5355.8795.15 <sup>1)</sup>
RF output switch (2:2, 7/16)	R&S®BBA-B121	5355.8895.12 <sup>1)</sup>
RF output switch (6:1, N)	R&S®BBA-B126	5355.8995.12
DC block input protection (N)	R&S®BBA-B132	5353.9236.03
Sample ports for forward and reflected RF power (N)	R&S®BBA-B140	5355.8837.02 <sup>1)</sup>
Detected sample ports for forward and reflected power (N)	R&S®BBA-B141	5355.8850.02 <sup>1)</sup>
Sample port switch (2 × 2:1, N)	R&S®BBA-B142	5355.8872.18 <sup>1)</sup>
Sample port switch (2 × 6:1, N)	R&S®BBA-B146	5355.8972.12
Transparent I/O	R&S®BBA-B160	5355.8889.02 <sup>1)</sup>
10" touchscreen	R&S®BBA-B200	Contact your local Rohde & Schwarz sales office.
Frequency extension, 380 kHz to 6 GHz, for R&S®BBA300-DE	R&S®BBA-B211	Contact your local Rohde & Schwarz sales office.
<b>Software options</b>		
Adjust operation point and high power	R&S®BBA-PK1	5352.8407.14 <sup>1)</sup>
Automatic RF on	R&S®BBA-K9	5352.8088.02
Fast amplifier mute	R&S®BBA-K130	5352.8220.02

<sup>1)</sup> The last two digits of the order number vary depending on the system configuration.

Your local Rohde & Schwarz expert will help find the best solution for you.  
Contact your local Rohde & Schwarz sales office for more information, [www.sales.rohde-schwarz.com](http://www.sales.rohde-schwarz.com)

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## Service at Rohde & Schwarz You're in great hands

- ▶ Worldwide
- ▶ Local and personalized
- ▶ Customized and flexible
- ▶ Uncompromising quality
- ▶ Long-term dependability

## Rohde & Schwarz

The Rohde&Schwarz technology group is among the trail-blazers when it comes to paving the way for a safer and connected world with its leading solutions in test & measurement, technology systems and networks&cybersecurity. Founded 90 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

[www.rohde-schwarz.com](http://www.rohde-schwarz.com)

## Sustainable product design

- ▶ Environmental compatibility and eco-footprint
- ▶ Energy efficiency and low emissions
- ▶ Longevity and optimized total cost of ownership

Certified Quality Management

ISO 9001

Certified Environmental Management

ISO 14001

## Rohde & Schwarz training

[www.training.rohde-schwarz.com](http://www.training.rohde-schwarz.com)

## Rohde & Schwarz customer support

[www.rohde-schwarz.com/support](http://www.rohde-schwarz.com/support)

