

R&S® BBA300

BROADBAND AMPLIFIER

Ultrabroad frequency range, high performance
and exceptional RF characteristics



Product Brochure
Version 07.00

ROHDE & SCHWARZ

Make ideas real



AT A GLANCE

The R&S®BBA300 broadband amplifiers are a generation of extremely compact semiconductor broadband amplifiers that are designed to be failsafe. They have 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 offer a high degree of flexibility in terms of system configuration 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 modular mechanical design allows versatile scaling of the R&S®BBA300 broadband amplifiers. The frequency range and power level can also be expanded.

The software platform provides a modern, user-friendly operating experience with a web GUI or 10" touchscreen. Role based operations and functional extensions can be activated as required.

The bias point can be adjusted between class A and class AB during operation for higher efficiency. Additional RF power can be enabled with good matching at the RF output.

The R&S®BBA300 product family includes the following amplifier series:

- ▶ R&S®BBA300-CDE (380 MHz to 6 GHz)
- ▶ R&S®BBA300-DE (1 GHz and 6 GHz)
- ▶ R&S®BBA300-F (6 GHz to 13 GHz)
- ▶ R&S®BBA300-FG (6 GHz to 18 GHz)

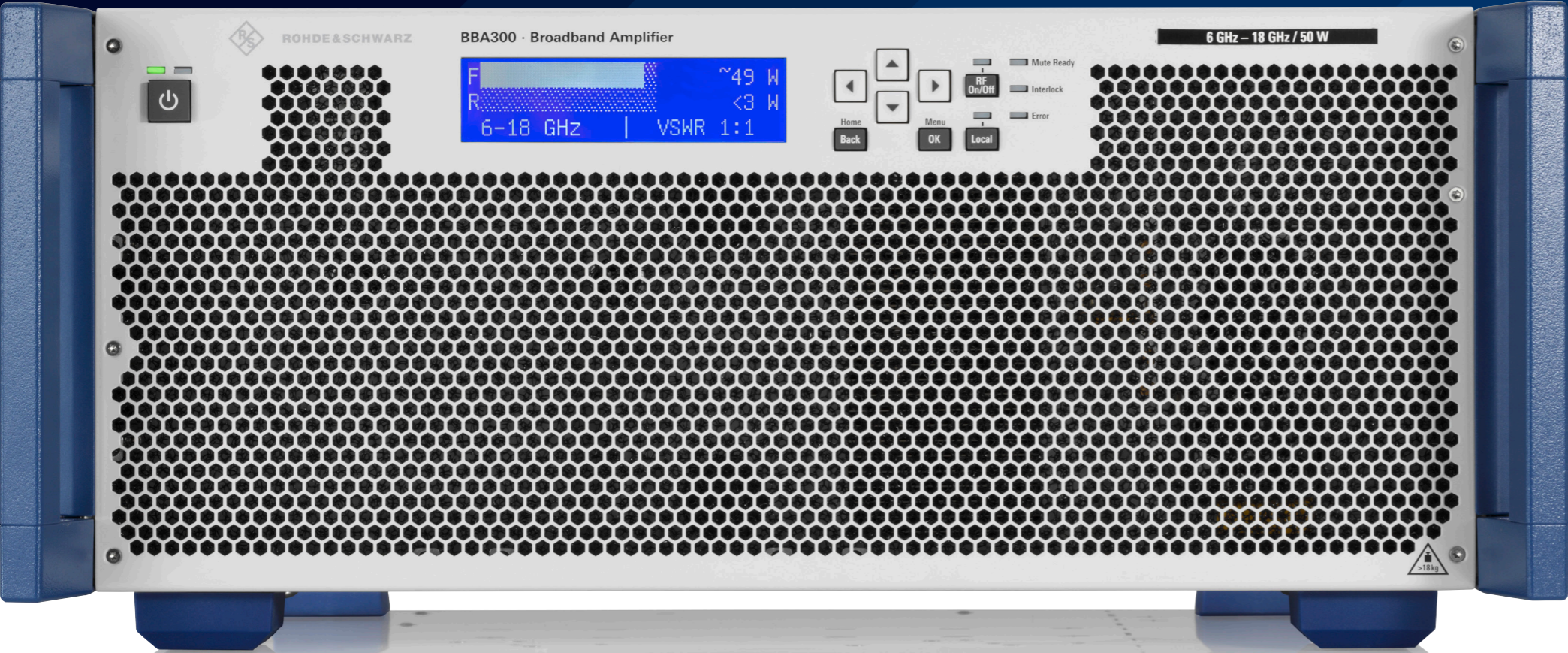
Thanks to their continuous, ultrabroad frequency ranges from 380 MHz to 6 GHz (R&S®BBA300-CDE) and from 6 GHz to 18 GHz (R&S®BBA300-FG), the R&S®BBA300-CDE and R&S®BBA300-FG amplifier series cover the entire range of GSM, LTE, 5G and GPRS mobile communications frequencies along with the WLAN, Bluetooth® and Zigbee wireless standards and numerous EMC standards up to 18 GHz. These amplifier series are suitable for a multitude of applications and are resistant to reflections and mismatches, which makes them ideal for use in electromagnetic susceptibility (EMS) test facilities. Another potential application is the development of passive RF components for radar and communications systems. Here, the R&S®BBA300 amplifiers can be used in passive intermodulation (PIM) tests to validate and specify RF components.

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

The R&S®BBA300-F amplifier series is designed for applications from 6 GHz to 13 GHz. The amplifiers can be upgraded to a higher bandwidth at any time.

KEY FACTS

- ▶ Continuous RF signal sweeps across ultrabroad frequency ranges up to 18 GHz
- ▶ Linear RF output power up to 300 W with outstanding noise power density, a low noise figure and excellent harmonic characteristics
- ▶ Suitable for amplitude, frequency, phase, pulse and complex OFDM modulation modes
- ▶ Resistant to mismatch at RF output
- ▶ High availability thanks to smart protection concepts
- ▶ Smart due to versatile settings and key enabled functions
- ▶ Flexible and scalable functions and configuration, expandable frequency range and power



BENEFITS

Ultrabroad frequency band
▶ [page 6](#)

One amplifier, many applications
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Compact, scalable, flexible
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Reliable with high availability
▶ [page 11](#)

ROHDE & SCHWARZ BROADBAND AMPLIFIERS – MODEL OVERVIEW



R&S®BBA130, desktop model



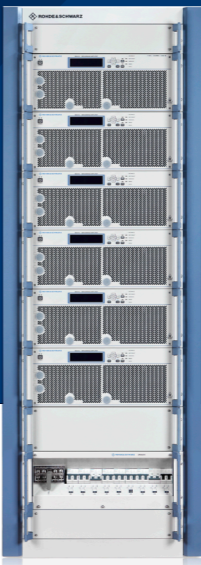
R&S®BBA150, desktop model



R&S®BBA300-FG50, desktop model



R&S®BBL200

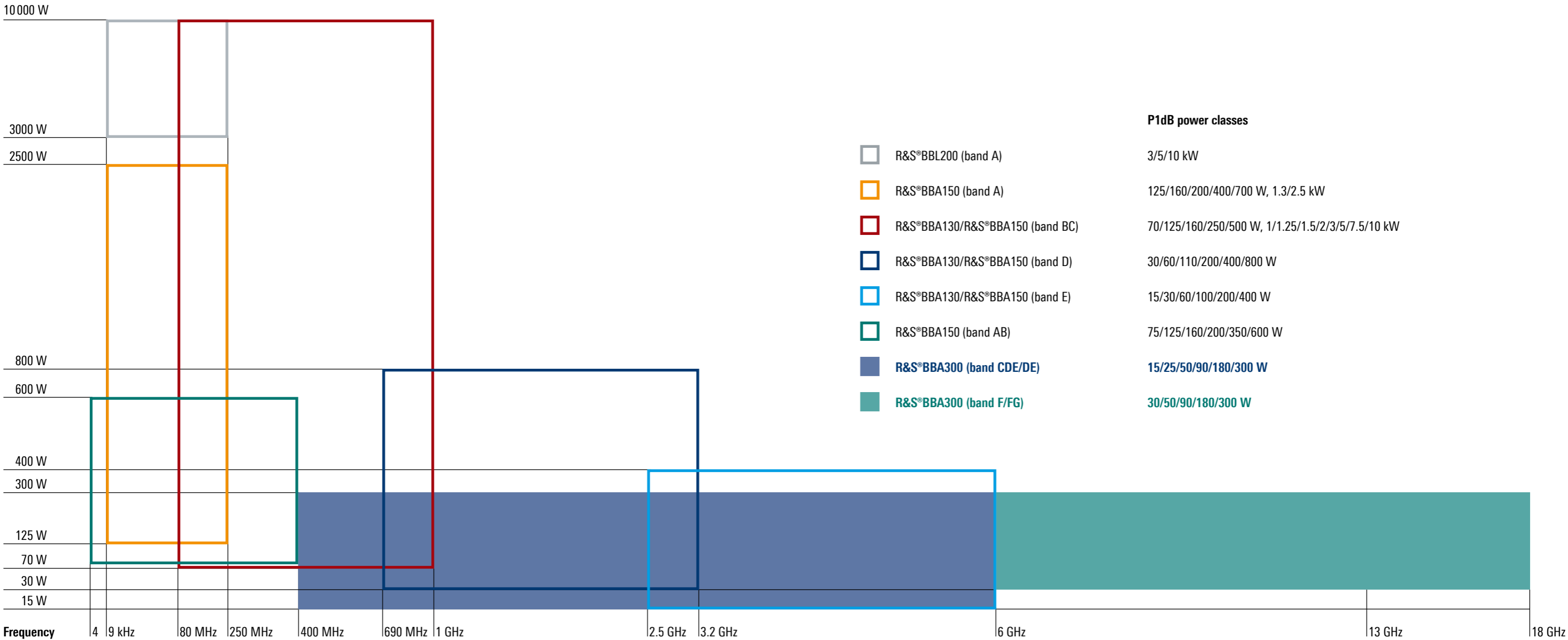


R&S®BBA150, rack model



R&S®BBA300-CDE300,
rack model

1 dB compression point (P1dB)



ULTRABROAD FREQUENCY BAND

- ▶ Broadband gain with output power up to 300 W in the following frequency ranges:
 - 380 MHz to 6 GHz (R&S®BBA300-CDE amplifier series)
 - 1 GHz to 6 GHz (R&S®BBA300-DE amplifier series)
 - 6 GHz to 13 GHz (R&S®BBA300-F amplifier series)
 - 6 GHz to 18 GHz (R&S®BBA300-FG 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
- ▶ Suitable for amplitude, frequency, phase, pulse and complex OFDM modulation modes

The R&S®BBA300 amplifier series provide broadband gain in the frequency ranges from 380 MHz to 6 GHz (R&S®BBA300-CDE), from 1 GHz to 6 GHz (R&S®BBA300-DE), from 6 GHz to 13 GHz (R&S®BBA300-F) and from 6 GHz to 18 GHz (R&S®BBA300-FG) with output power up to 300 W.

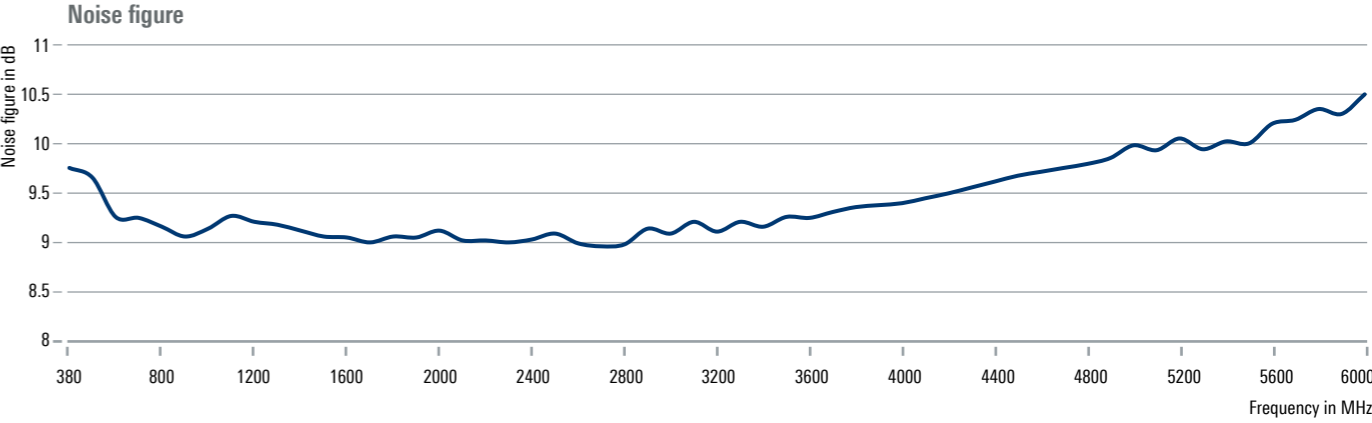
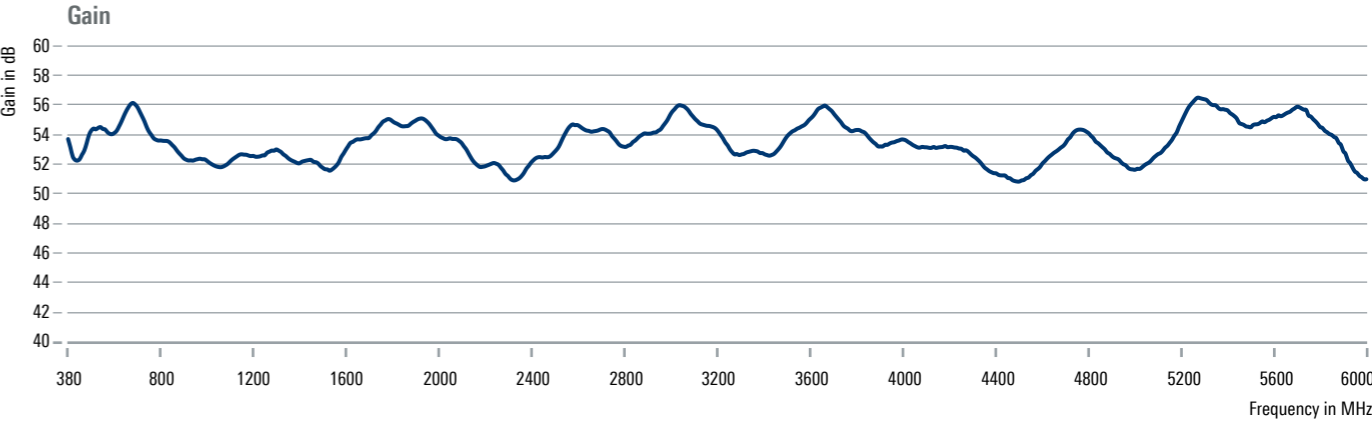
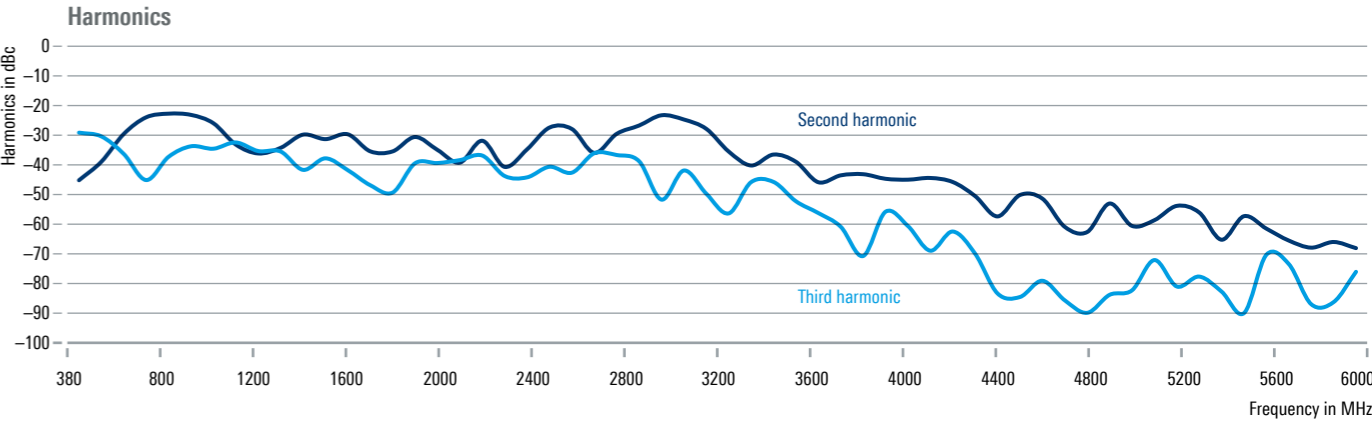
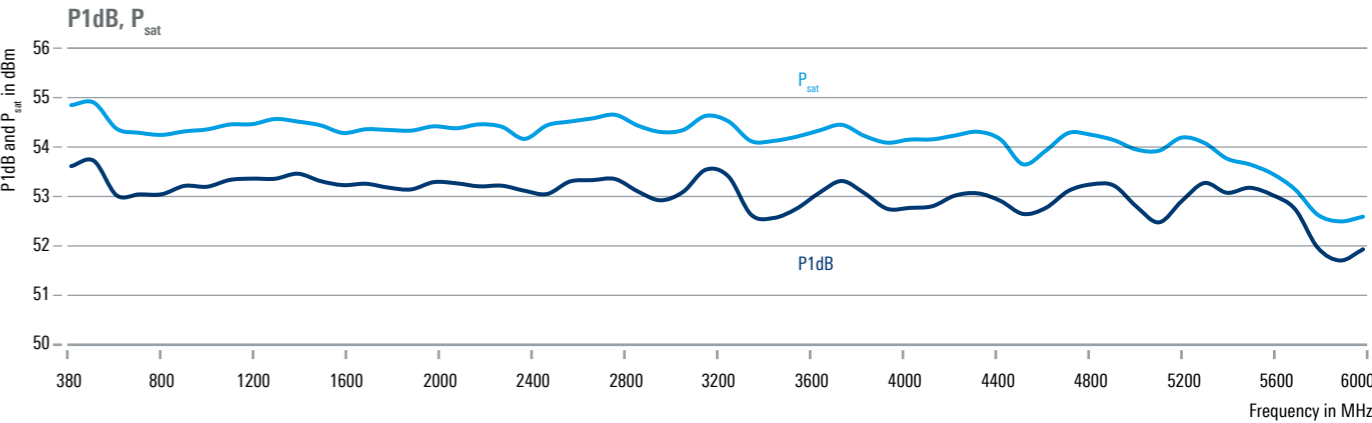
The amplifiers support continuous sweeping of the RF signal across the entire frequency range and speed up RF component and device testing and validation in the mobile communications and wireless industry. Narrowband CW signals, signals with simple AM, FM, PM or ϕ M modulation and broadband, complex OFDM signals with 200 MHz bandwidth can be amplified. The amplifier series can be used for the GSM, LTE, 5G and GPRS mobile communications frequencies, for the WLAN, Bluetooth® and Zigbee wireless standards as well as for numerous EMC standards from 380 MHz to 18 GHz.

High linearity, outstanding noise power density as low as -110 dBm (1 Hz), a noise factor of 10 dB and harmonic characteristics of -25 dBc or better ensure a low adjacent channel leakage ratio (ACLR) and excellent transmission characteristics without an increased 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, without requiring any additional components such as filters.

Amplifier system, consisting of 2 × R&S®BBA300 and 2 × R&S®BBA150, deployed in radiated electromagnetic susceptibility tests



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

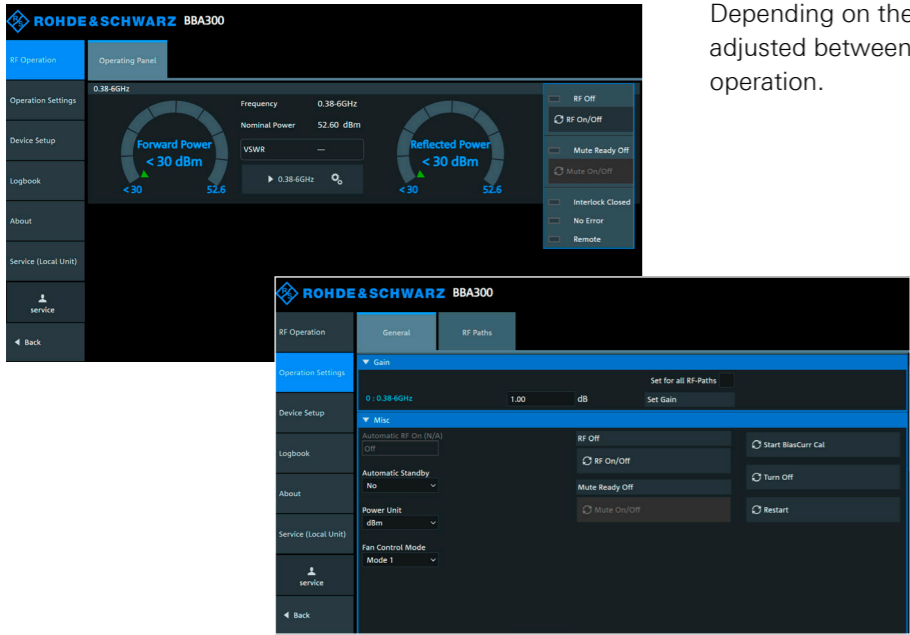


ONE AMPLIFIER, MANY APPLICATIONS

- ▶ 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

The R&S®BBA300 broadband amplifiers have a software platform for control and monitoring. This can be used to define different roles with tiered privileges for configuration and operation. Dedicated access can be granted to the comprehensive parameter sets. The innovative operating concept, supported by the optional 10" touchscreen (R&S®BBA-B200), provides a unique user experience with straightforward operation on site or remotely using a web GUI. Test sequences can be automated using remote control SCPI commands via a standard Ethernet interface. The SNMP protocol enables remote control. The functional range of the R&S®BBA300 broadband amplifiers is scalable thanks to the modular software structure. Building on the basic functions, users can enter a keycode to add the functions they require.



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

The R&S®BBA300 is ideal for a wide variety of applications, including EMC immunity measurements, development and production validation tests and power sensor calibration. Deployments in particle accelerators for medical or scientific research as well as in plasma applications are also possible. Each application requires different amplifier characteristics.

The R&S®BBA300-PK1 software option offers two powerful tools for optimizing the output signals: setting the bias point between class A and class AB and selecting between maximum output power and mismatch tolerance. This helps 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 signal transfer within the amplifier. Placing the bias point in the middle of the transistor's linear region makes it a class A amplifier. A class A bias point provides excellent linearity with very good harmonic performance. Adjusting the bias point to obtain a class AB amplifier enables faithful reproduction of pulsed signals and improved 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, a bias point is selected in class AB. Depending on the requirements, the bias point can be adjusted between class A and class AB in ten steps during operation.

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

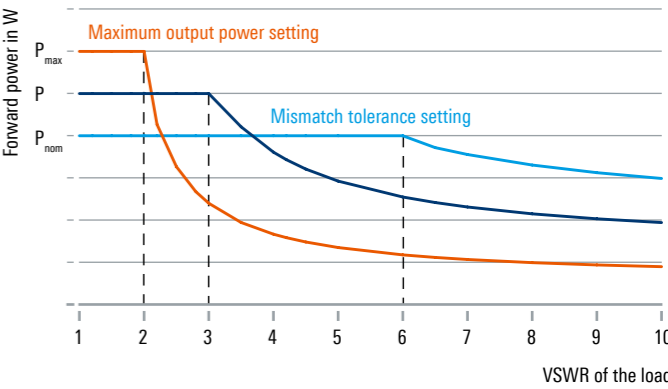
Maximum output power or high mismatch tolerance

Amplifiers are 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 maximum output power with good matching on the RF output (voltage standing wave ratio (VSWR) not lower than $\approx 2:1$) and high mismatch tolerance with delayed power reduction (starting at $VSWR \approx 6:1$).

Impedance matching at the amplifier output is generally well suited for design and product validation tests when good matching is required for DUTs with 50Ω systems or when a circulator is inserted between the amplifier and DUT. The installed amplifier power margin is then fully used. A mismatch can only be caused by a faulty DUT or circulator. In this case, the amplifier power can be reduced because it only needs to protect itself.

EMC applications with poorly matched antennas or DUT measurements with input impedance deviating significantly from 50Ω must use the amplifier to produce the desired output power for as long as possible. Here, the amplifier may only reduce power for self-protection purposes in the case of extreme mismatching.

Maximum output power compared to high mismatch tolerance



Amplifier characteristics for various control parameter settings and typical applications

	Class AB	Class A
	<ul style="list-style-type: none">▶ Faithful reproduction of a pulsed signal▶ Good efficiency	<ul style="list-style-type: none">▶ High linearity▶ High spectral purity
High power	<ul style="list-style-type: none">▶ Signals with high crest factor▶ Good matching required at amplifier output	
High mismatch tolerance		
Design and product validation tests	<ul style="list-style-type: none">▶ Tests with pulsed signals▶ Slam testing▶ Ruggedness test▶ Artificial aging	<ul style="list-style-type: none">▶ Intermodulation tests, e.g. PIM tests▶ Multitone tests▶ Peak-to-average ratio tests
Various tests	<ul style="list-style-type: none">▶ Maximum output power dependent on amplitude and phase of mismatch	
EMC testing		<ul style="list-style-type: none">▶ Poor matching of antenna or current probe, reflections from DUT and/or EMC chamber
Scientific applications		<ul style="list-style-type: none">▶ Linear broadband amplifiers

COMPACT, SCALABLE, FLEXIBLE

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

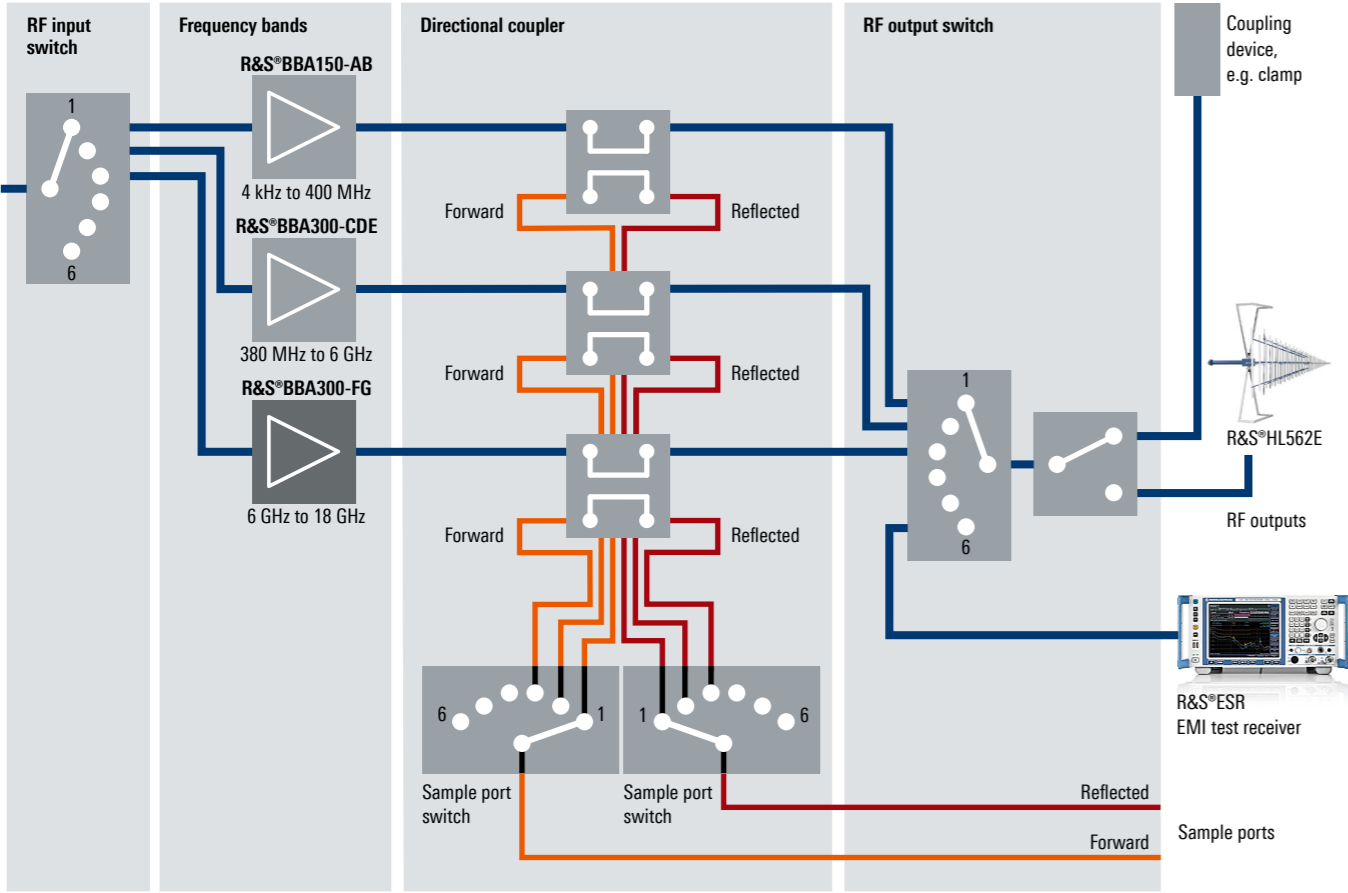
The R&S®BBA300 broadband amplifiers offer exceptionally high RF power and ultrabroad bandwidth in a very small package, which would otherwise require a much more complex design. The R&S®BBA300-CDE180 can achieve a power density of 180 W P1dB in just four height units.

The design is optimized for flexibility in a small footprint. The compact and modular design of the amplifiers and other components allow for scalable, highly integrated rack systems with 19" plug-in units. The frequency range and power of the amplifier can be flexibly configured and extended at any time, which safeguards user investments.

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

Switch options make it possible to combine individual amplifiers for a specific application. In this way, two frequency ranges such as CDE and FG (380 MHz to 18 GHz) in a 4 HU desktop model with a power of 90 W/50 W or multiple frequency ranges can be grouped into a system. The R&S®BBA300 broadband amplifiers are fully compatible with R&S®BBA130 and R&S®BBA150 broadband amplifiers that support other frequency ranges.

Multiband amplifier system from 4 kHz to 18 GHz realized with switch options



RELIABLE WITH HIGH AVAILABILITY

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

The innovative R&S®BBA300 family features high availability and robust operation. The sophisticated RF design ensures reliable, continuous operation even with a mismatched load on the RF output or with a shorted or open RF output. EMC labs appreciate the high mismatch tolerance of Rohde&Schwarz broadband amplifiers, which can still provide full RF forward power at the output even with a VSWR of 6:1.

Minimizing downtime is vital for users. The Rohde&Schwarz amplifiers have high availability, stability and reliability. Smart protection concepts enable operation at reduced power even in the event of transistor failures. This allows continued operation of applications with low power requirements. Functions such as periodic quiescent current adjustment for compensating component aging and drift increase the life span of the broadband amplifiers.

To support the high system availability of the R&S®BBA300 family, Rohde&Schwarz offers flexible and customizable service packages. They provide fast support for maximum investment protection. The amplifiers are backed up by extensive logging functions, spare parts and equipment stocks, on-site service and regular maintenance. This ensures that R&S®BBA300 amplifiers are continuously and reliably ready for operation at all times and remain highly available throughout their lifetime.

Service levels overview

Maintenance and support services	Basic	Customized	Premium Desktop model	Premium 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 ¹⁾	–	○	•	–
Standard, with no defined TAT	•	•	•	•
On-site service ¹⁾				
Fast, start of work within 2 working days	–	○	–	•
On demand, without assured times	–	○	–	•
Parts for fast repair ¹⁾	–	○	•	•
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 ¹⁾	–	○	•	•
Regular review meeting, once per year	–	○	•	•

¹⁾ Depending on 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
R&S®BBA300-F	continuous	6 GHz to 13 GHz
R&S®BBA300-FG	continuous	6 GHz to 18 GHz
Rated power	380 MHz to 6 GHz	15 W to 300 W
	1 GHz to 6 GHz	15 W to 300 W
	6 GHz to 13 GHz	30 W to 300 W
	6 GHz to 18 GHz	30 W to 300 W
Nominal output load		50 Ω
Gain flatness		±3.5 dB or better (see specifications)
Gain adjustment range		> 15 dB
Bias point		class A
	optional	adjustable, class A through class AB
Forward output power	VSWR < 6:1	nominal output power
	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 tolerance, 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	depending on output power	–110 dBm (1 Hz)
Input level for nominal output power		0 dBm
Nominal input impedance		50 Ω
RF and sample connectors		
RF input		N female
RF output		N female, WRD650
RF sample ports		N female
Detected sample ports		N female
Graphical user interface		
Local graphical 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 mode		
Ethernet		RJ-45, 10/100/1000 Mbit/s, half/full duplex, autonegotiation
Protection		
Load VSWR		infinite
Interlock		1 automatic interlock, 1 interactive interlock
Input protection against bias voltage	optional	DC blocker for ≤ 50 V DC
Thermal overload		shutdown in case of thermal overload
Cooling		air cooling, forced air, built-in fans, air entry at front, air exit at rear

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.
Base units		
Broadband amplifier, frequency band from 380 MHz to 6 GHz		
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
Broadband amplifier, frequency band from 1 GHz to 6 GHz		
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
Broadband amplifier, frequency band from 6 GHz to 13 GHz		
30 W, air-cooled, 4 HU desktop model	R&S®BBA300	BBA300-F30
50 W, air-cooled, 4 HU desktop model	R&S®BBA300	BBA300-F50
90 W, air-cooled, 5 HU desktop model	R&S®BBA300	BBA300-F90
180 W, air-cooled, 5 HU desktop model	R&S®BBA300	BBA300-F180
300 W, air-cooled, 12 HU rack model	R&S®BBA300	BBA300-F300
Broadband amplifier, frequency band from 6 GHz to 18 GHz		
30 W, air-cooled, 4 HU desktop model	R&S®BBA300	BBA300-FG30
50 W, air-cooled, 4 HU desktop model	R&S®BBA300	BBA300-FG50
90 W, air-cooled, 5 HU desktop model	R&S®BBA300	BBA300-FG90
180 W, air-cooled, 5 HU desktop model	R&S®BBA300	BBA300-FG180
300 W, air-cooled, 12 HU rack model	R&S®BBA300	BBA300-FG300
Options		
Hardware options		
GPIO remote control	R&S®BBA-B101	5355.8250.02 ¹⁾
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 ¹⁾
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 ¹⁾
RF output switch (2:2, 7/16)	R&S®BBA-B121	5355.8895.12 ¹⁾
RF output switch up to 18 GHz (2:1 or 1:2, N)	R&S®BBA-B125	5355.8795.25
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 ¹⁾
Sample ports, for forward and reflected RF power (N)	R&S®BBA-B141	5355.8850.02 ¹⁾
Sample port switch (2 × 2:1, N)	R&S®BBA-B142	5355.8872.18 ¹⁾
Sample port switch (2 × 6:1, N)	R&S®BBA-B146	5355.8972.12
Transparent I/O	R&S®BBA-B160	5355.8889.02 ¹⁾
10" touchscreen	R&S®BBA-B200	2512.2200.20
Frequency extension to 380 MHz to 6 GHz, for R&S®BBA300-DE	R&S®BBA-B211	5352.8607.07 ¹⁾
Frequency extension to 6 GHz to 18 GHz, for R&S®BBA300-F	R&S®BBA-B212	5352.8607.14 ¹⁾

¹⁾ The last two digits of the order number depend on the system configuration.

Designation	Type	Configuration No.
Software options		
Setting bias point and high RF output power	R&S®BBA-PK1	5352.8407.14 ¹⁾
Automatic RF on	R&S®BBA-K9	5352.8088.02
Fast amplifier mute	R&S®BBA-K130	5352.8220.02

¹⁾ The last two digits of the order number depend on the system configuration.

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Your local Rohde&Schwarz expert will help find the best solution for you.
Contact your local Rohde&Schwarz sales office for more information.

Rear view of R&S®BBA300



FROM PRESALES TO SERVICE. AT YOUR DOORSTEP.

The Rohde & Schwarz network in over 70 countries ensures optimum on-site support by highly qualified experts.

User risks are reduced to a minimum at all project stages:

- Solution finding/purchase
- Technical startup/application development/integration
- Training
- Operation/calibration/repair



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

Rohde & Schwarz

The Rohde & Schwarz technology group is among the trailblazers 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 more than 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.

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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

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