Широкополосный усилитель BBA150

R&S®BBA150 Broadband Amplifier

At a glance

The R&S®BBA150 broadband amplifier family generates power in the frequency range from 4 kHz to 6 GHz. The compact amplifiers are rugged and feature high availability. They are ideal for amplitude, frequency, phase and pulse modulation. Extensive switching options for input, output and sample ports are available for different applications.

R&S®BBA150-A2500

The R&S®BBA150 broadband amplifiers cover a total of four frequency bands: 9 kHz to 250 MHz, 4 kHz to 400 MHz, 80 MHz to 1 GHz, 0.69 GHz to 3.2 GHz and 2.5 GHz to 6 GHz. They can be used to address a variety of applications, including the various standards for EMS measurements up to 6 GHz. In the industry environment, the R&S®BBA150 broadband amplifiers are suitable for development and product validation tests in quality assurance and in the development and production of components. Other fields of use include research, physical engineering and communications.

The R&S®BBA150 broadband amplifiers are based on a modular, lightweight design that is optimized for the required frequency band. They are available in two versions. The low-power amplifier comes as a 4 HU 19" rackmount that can be used as a desktop model or installed in a rack. Devices with higher power must be installed in racks. The amplifiers are operated either using display and buttons, or via remote control interface (automated operation) or via a web browser.

The modular design allows you to later upgrade the power and frequency range. The comprehensive service concept and global availability of spare parts promote the trust and confidence of customers around the world.

Key facts

- Frequency bands: 9 kHz to 250 MHz, 4 kHz to 400 MHz, 80 MHz to 1.0 GHz, 0.69 GHz to 3.2 GHz, 2.5 GHz to 6.0 GHz
- Output power from 15 W to 3000 W
- 100 % mismatch tolerance
- Suitable for amplitude, frequency, phase and pulse modulation
- Three-year warranty and flexible service level agreements

R&S®BBA150 Broadband Amplifier

Benefits and key features

One of the most advanced broadband amplifiers on the market

- Sophisticated RF design
- Compact and lightweight
- Series production in one of Europe's most progressive plants

▷ page 4

Reliable with high availability

- Outstanding expertise in amplifier development
- Cost benefit due to low downtime

▷ page 5

Flexible control and operation

- Manual operation
- Local and remote operation via web browser and PC
- Integration into the R&S®EMC32 EMC measurement software
- Remote control via Ethernet
- Safety thanks to two different interlocks

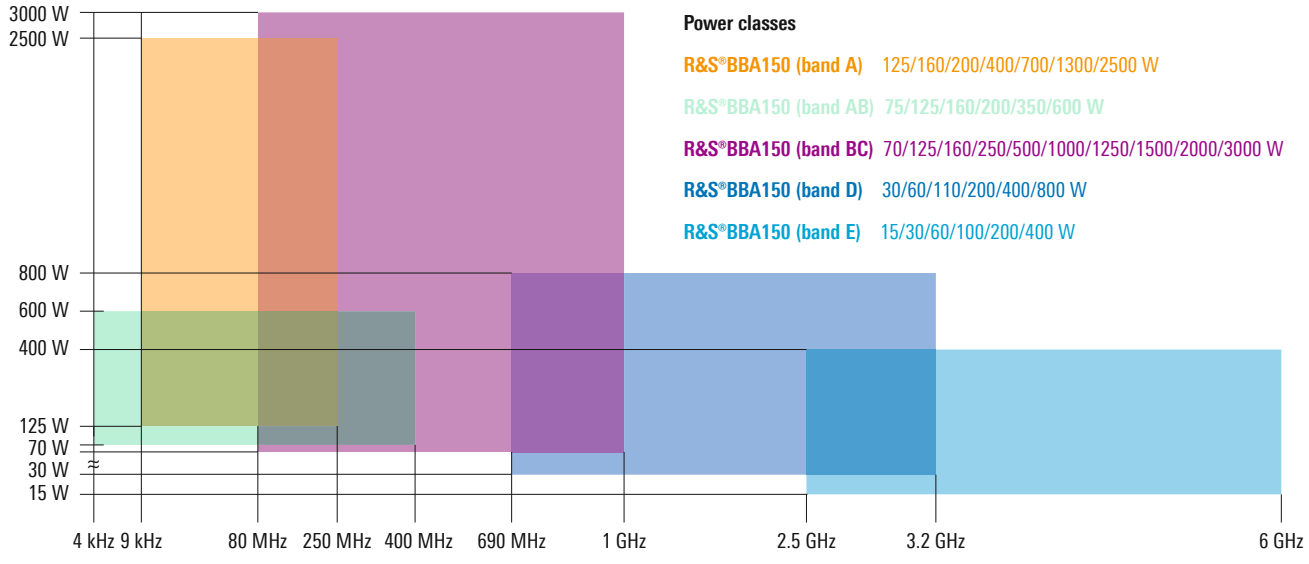
▷ page 6

All in one device

- Compact design and modular structure
- Compact and flexible: twin-band and dual-band amplifiers in four height units
- Extensive switching options for inputs, outputs and sample ports

▷ page 8

Model overview



One of the most advanced broad-band amplifiers on the market

Outstanding RF design in combination with high-quality series production in one of Europe's most progressive plants

Sophisticated RF design

State-of-the-art design and simulation programs used during development, the use of power semiconductors from internationally leading manufacturers and the decades of experience of the engineers in develop-ing amplifiers produce the most advanced amplifier design currently available. In the frequency band from 2.5 GHz to 6 GHz, semiconductor dice directly bonded onto printed boards make it possible to achieve high output power. As a result, parasitic effects caused by housed transistors are avoided.

Efficiency coupled with ruggedness ensures smooth operation. Lean firmware with effective monitoring and protection mechanisms provides operational safety. Generous dimensioning of the RF amplifier stages provides sufficient margin and ensures compliance with warranted data sheet parameters.

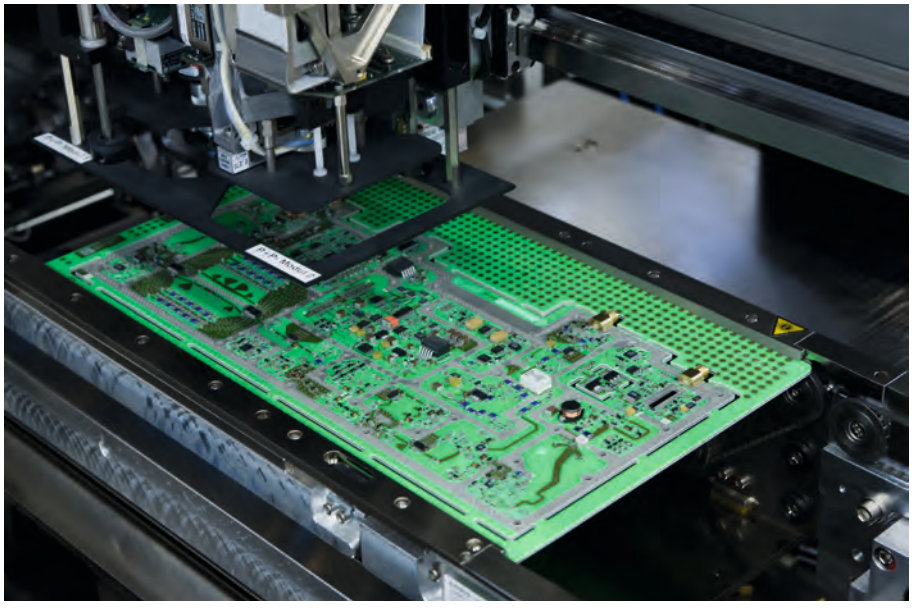
Compact and lightweight

The R&S®BBA150 also sets new standards in terms of mechanical design. Due to its lightweight design and special aluminum-copper heat sink, the R&S®BBA150 weighs only half as much as conventional amplifiers in the same power class. If desired, it is possible to combine different frequency bands in a single amplifier. The RF output power of up to 500 W below 1 GHz and up to 200 W above 1 GHz in just four height units means excellent power density.

Series production in one of Europe's most progressive plants

The R&S®BBA150 broadband amplifiers are series-produced in one of Europe's most progressive plants. The multiple award-winning [1] plant in the town of Teisnach (Germany) offers superior manufacturing depth. From precision mechanical engineering and metal-working to printed board production and final assembly, all manufacturing steps are united under the same roof. Auto-mated final test setups ensure that the plant delivers only specification-compliant products to its customers.

1) Awards received by the Teisnach plant include:
- 2010, 2014 Factory of the Year, Germany
- 2013 Best Factory, award winner of European industrial excellence competition
- 2014 Bavarian Quality Award
- 2016 Global Excellence in Operations (GEO) overall award winner, Germany



Automated insertion of components into printed boards at .

Reliable with high availability

Broadband amplifiers as reliable as the sound and TV broadcast transmitters from

Outstanding expertise in amplifier development

The R&S®BBA150 broadband amplifiers are highly tolerant to mismatch and rugged enough to handle short-circuiting at the RF end or an open RF output. The expertise gained over many years in the development of power amplifiers is based on the R&D work for sound and TV broadcast transmitters. Their reliability is well-known and a major reason for the company's global market lead-ership in digital terrestrial transmitter technology.

Cost benefit due to low downtime

The market launch of the R&S®BBA100 broadband amplifier family in 2010 underscored the claim to offer stable, reliable amplifiers for maximum customer benefit. Low downtime is an important economic factor. The R&S®BBA150 broadband amplifiers are the next logi-cal step along this path.

Transfer of know-how

All the sound and TV broadcast transmitter manufacturing know-how has gone into the development of the broadband amplifiers.

1963:
VHF radio transmitter with 2 × 5 kW

2010:
R&S®BBA100
broadband amplifier

2013:
R&S®BBA150
broadband amplifier

2014:
R&S®BBL200
broadband amplifier

2016:
R&S®BBA 130
broadband amplifier

Flexible control and operation

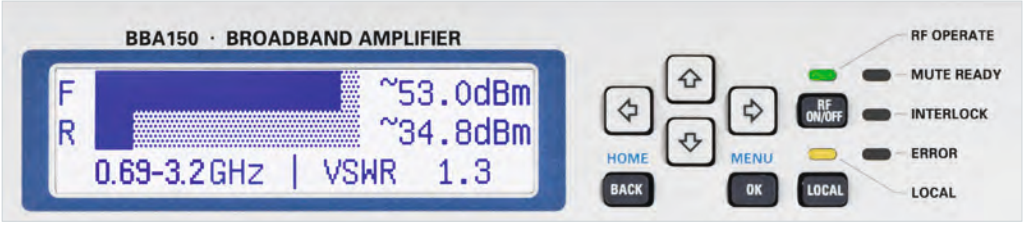
Operation of the R&S®BBA150 is always efficient, including local and remote control and operation via web GUI.

Manual operation

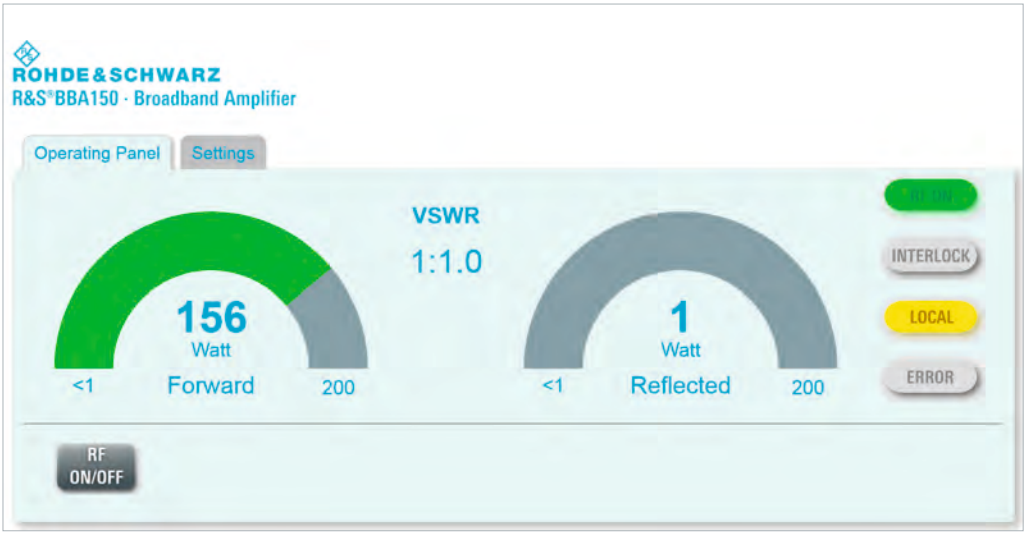
The R&S®BBA150 is directly operated via the display and the buttons on its front panel. This is ideal for use in labs and makes it easy to change settings. A clever menu structure provides straightforward access to all essential information and possible settings; during operation, the RF output power, reflected power and VSWR are displayed.

Local and remote operation via web browser and PC

The web GUI integrated into the R&S®BBA150 is called up via LAN and web browser. The R&S®BBA150 can be conveniently operated via its graphical user interface using a laptop near the amplifier or a control workstation PC. A common web browser (e.g. Google Chrome, Mozilla Firefox, Microsoft Internet Explorer) is all that is needed.



Display and buttons on the R&S®BBA150 front panel.



Operating panel in the web GUI of the R&S®BBA150.

Integration into the R&S®EMC32 EMC measurement software

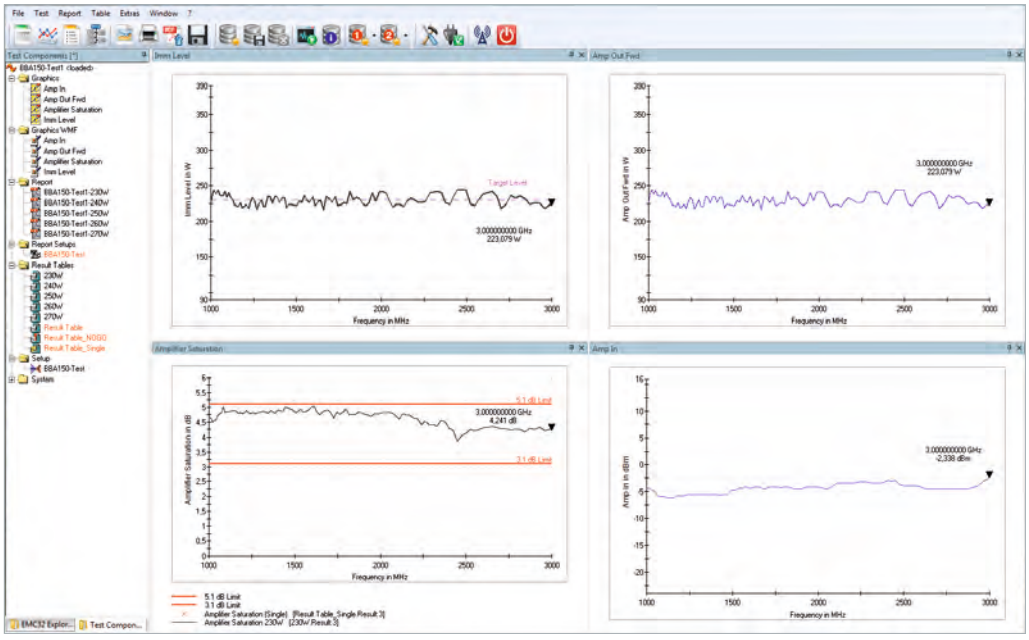
Complex EMC measurement scenarios almost always require the use of higher-level measurement and control software, for example R&S®EMC32. The complete integration of the R&S®BBA150 into the EMC measurement software offers many different options for setting and controlling the amplifier for immunity measurements in line with common standards such as CISPR, IEC, ISO, EN, ETSI, VDE, FCC and ANSI.

Remote control via Ethernet

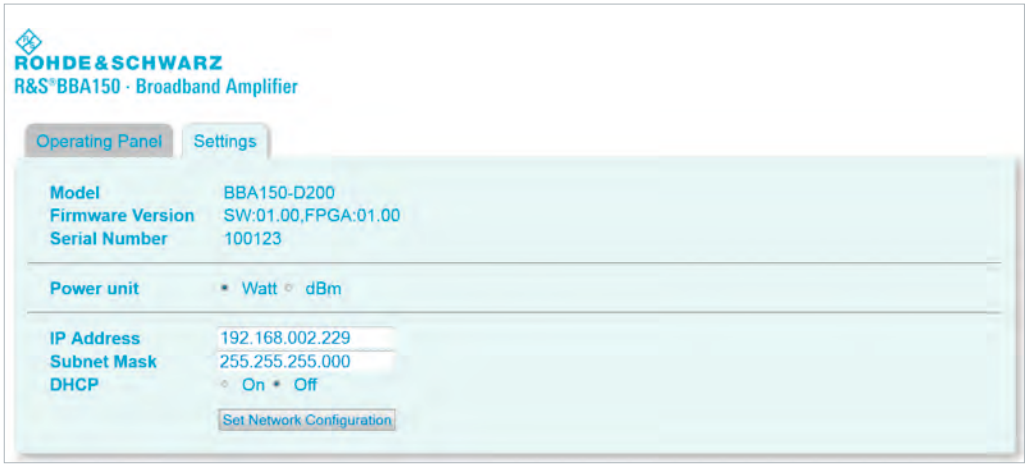
The standard Ethernet interface makes it possible to automate test sequences using remote control SCPI commands. To make integration especially easy, the IP network address can be set manually or assigned automatically via DHCP.

Safety thanks to two different interlocks

Two different interlocks are available. You can choose the one that best suits your application. The automatic device interlock is supplemented by a second, interactive interlock. The automatic device interlock restarts the amplifier without user interaction as soon as the interlock circuit is closed again. The interactive interlock requires user confirmation before RF power can be output again.



R&S®EMC32 EMC measurement software.



Settings panel in the web GUI of the R&S®BBA150.

All in one device

Flexible amplifier systems with various frequency bands and power classes

Compact design and modular structure

Though compact, the R&S®BBA150 broadband amplifier offers functions that normally involve significantly higher technical investment. The design is optimized for top flexibility in a small footprint. The compact, modular design of the amplifier stages and other components allows the set-up of highly integrated systems based on 19" rackmounts. The frequency and power of these rack units can be flexibly configured.

Compact and flexible: twin-band and dual-band amplifiers in four height units

Two frequency bands can be integrated into a 4 HU desktop model, either as a twin-band or a dual-band amplifier.

Twin-band amplifiers consist of two amplifiers, both with the same frequency band, that operate in parallel. These types of amplifiers are ideal for two-tone measurements and for applications that require the same test setup for multiple tests in a small space. Multiple twin-band units fit in a single rack.

Dual-band amplifiers contain two amplifiers with different frequency bands, and only one of these amplifiers is active at any given time. The optional switches for this option are integrated into the housing. The dual-band amplifiers cover the following frequency ranges: 9 kHz to 1 GHz, 80 MHz to 3.2 GHz and 690 MHz to 6 GHz.

The R&S®BBA150-A2500BC125 amplifier system in a 19" rack with 42 HU contains the following:

- Power amplifier, frequency band A, 2500 W
- Power amplifier, frequency band BC, 125 W
- Input switch
- Output switch
- Sample port switch

Extensive switching options for inputs, outputs and sample ports

Single-band and dual-band amplifiers can be combined to build a single system with multiple frequency bands. Numerous switching options allow you to mix and match the individual amplifiers to obtain the best configuration for your specific application.

Every scenario is covered by flexibly combining the following components:

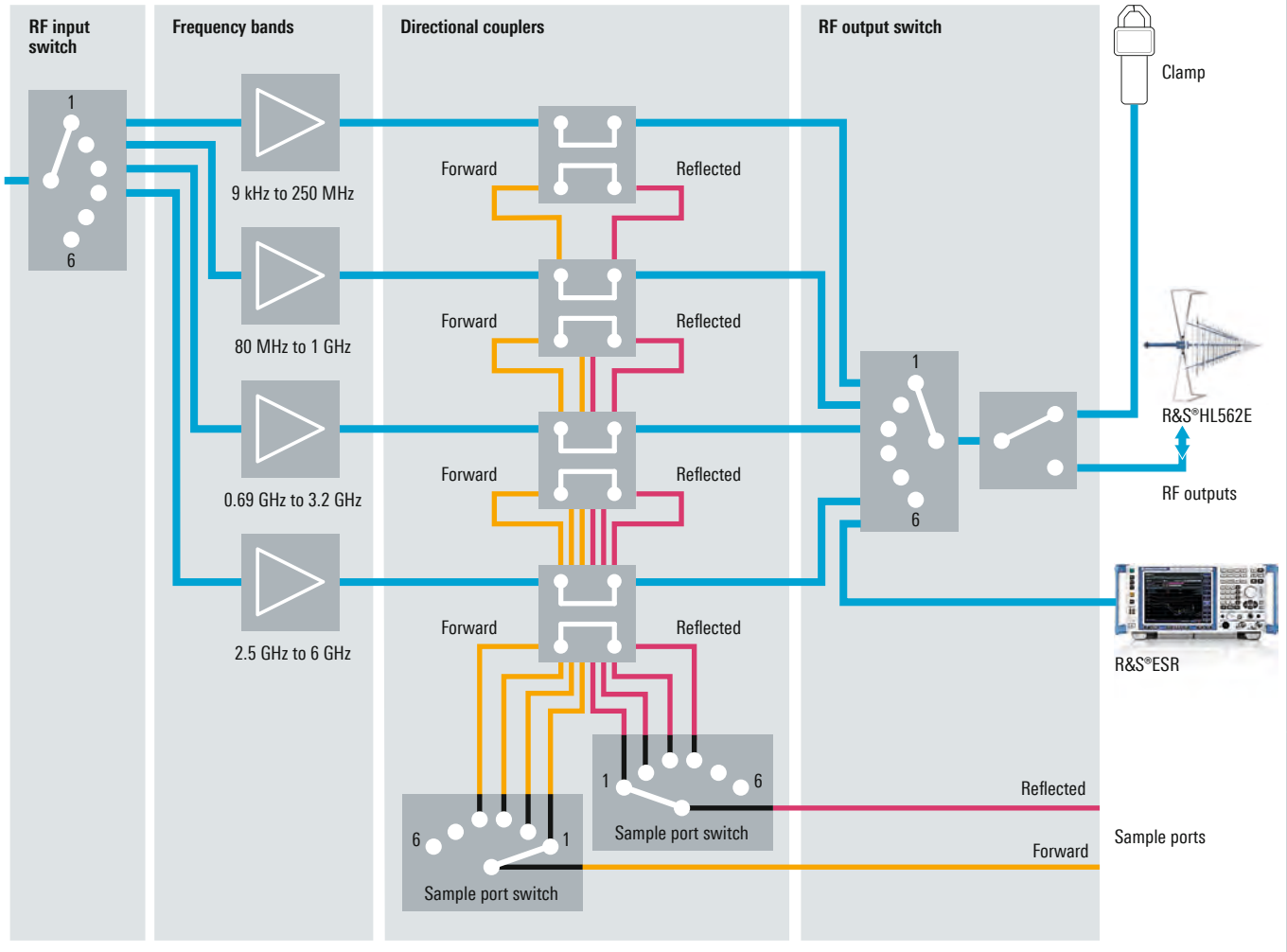
The input switch sets the RF input signal to one of the frequency bands so that a central input can be used without having to disconnect and reconnect the signal source.

Optional sample ports are available to measure the forward and reflected power at the amplifier's output. Sample port switches make the signals from the various frequency bands available at two central outputs.

RF output switches allow flexible connection of the frequency bands to different sinks, e.g. clamps or antennas. Different RF output switches can be configured in an application-specific manner.

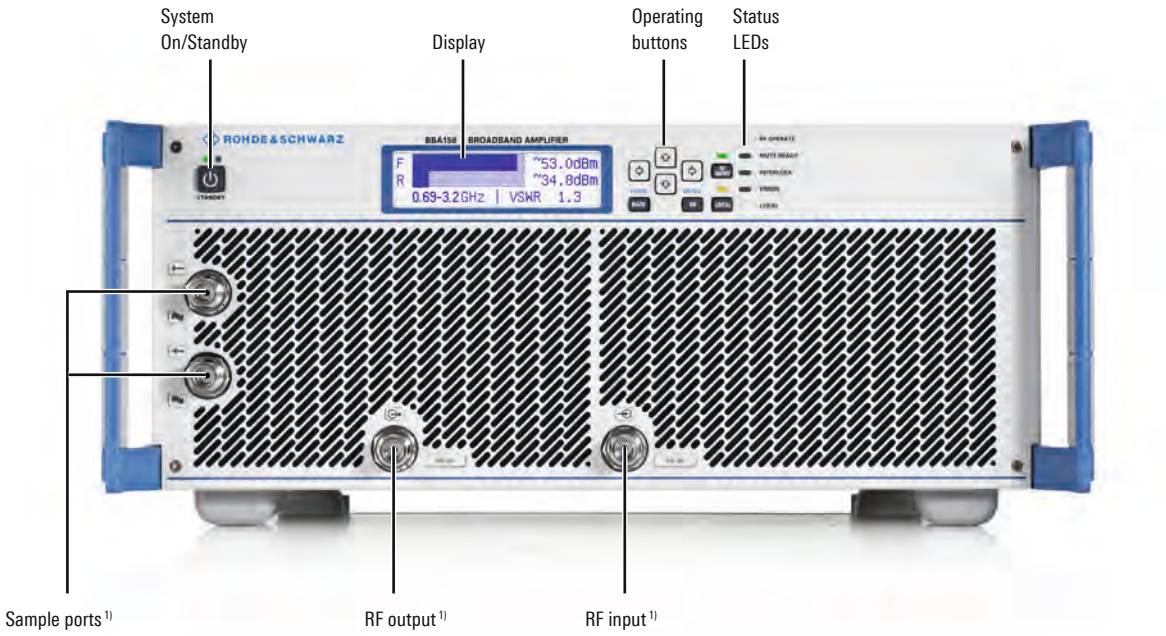
All switches in the system are controlled via the built-in system controller. The desired RF path can be selected with a single remote control command or a press of a button. An RF path is the signal path from the input to the output of the amplifier system.

Combined amplifier system with switching options



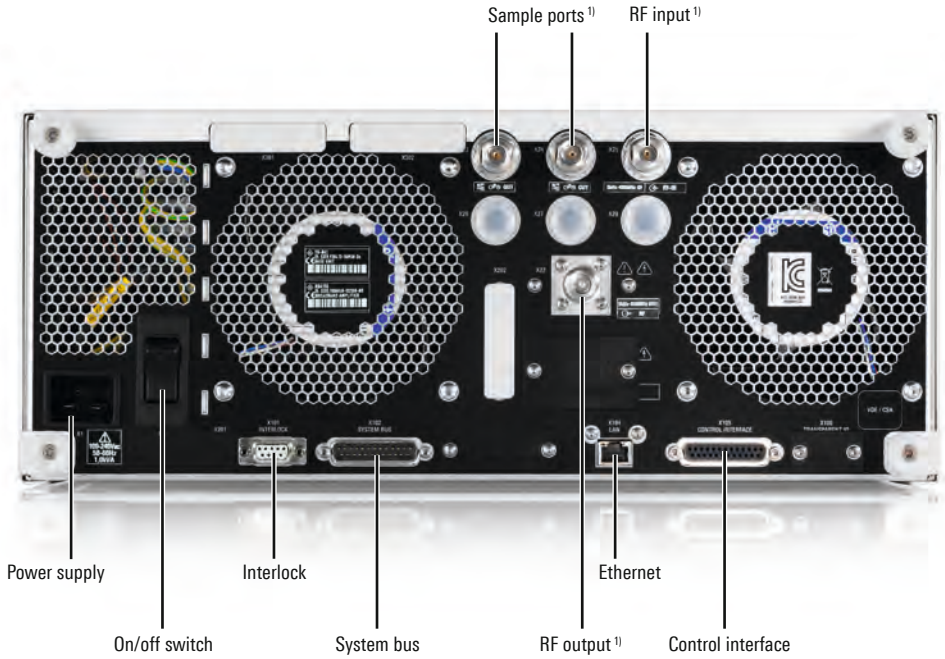
Functional elements
Desktop model

Front view



1) Optional or configuration-dependent.

Rear view



1) Optional or configuration-dependent.

Specifications in brief

Specifications in brief		
RF specifications		
Amplifier type		class A
Frequency bands		▮ 9 kHz to 250 MHz, instantaneously ▮ 4 kHz to 400 MHz ▮ 80 MHz to 1.0 GHz, instantaneously ▮ 0.69 GHz to 3.2 GHz, instantaneously ▮ 2.5 GHz to 6.0 GHz, instantaneously
Nominal output power	9 kHz to 250 MHz	125 W to 2500 W
	4 kHz to 400 MHz	75 W to 600 W
	80 MHz to 1.0 GHz	70 W to 3000 W
	0.69 GHz to 3.2 GHz	30 W to 800 W
	2.5 GHz to 6.0 GHz	15 W to 400 W
Nominal output load		50 Ω
Gain flatness		±4.0 dB (or better; see data sheet)
Gain adjustment range		> 15 dB
Modulation capability		AM, FM, φM, PM
Nominal input impedance		50 Ω
Max. RF input level		max. +15 dBm
	9 kHz to 250 MHz	max. +5 dBm
Input level for nominal output power		–3.4 dBm
Nominal output impedance		50 Ω
Output mismatch tolerance, VSWR		100%, without damage
RF and sample connectors		
RF input port		N female
RF output port		N female, 7/16 DIN female or 1 5/" EIA female
RF sample ports	forward output power, optional	N female
	reflected output power, optional	N female
Detected sample ports	forward output power, optional	N female
	reflected output power, optional	N female
Graphical user interface		
Local graphical display		200 × 48 pixel, monochrome
Web GUI	via Ethernet	RJ-45, 10/100 Mbit/s, autonegotiation, half/full duplex
Remote control		
Ethernet		RJ-45, 10/100 Mbit/s, autonegotiation, half/full duplex
General data		
Operating voltage range	R&S®BBA150-A125 to -A200/-AB75 to -AB200/-BC70 to -BC250/-D30 to -D110/-E15 to -E100	100 V to 240 V AC ± 10%, single phase, 50 Hz to 60 Hz ±6%
	R&S®BBA150-A400/-AB350/-D200/-E200	120 V to 240 V AC ± 10%, single phase, 50 Hz to 60 Hz ±6%
	R&S®BBA150-A700/-AB600/-BC500/-BC1000/-D400/-E400	200 V to 240 V AC ± 10%, single phase, 50 Hz to 60 Hz ± 6%
	R&S®BBA150-A1300/-A2500/-BC1250 to -BC3000/-D800	380 V to 415 V AC ± 10%, three phase, with N, 50 Hz to 60 Hz ± 6%
Air cooling		forced air, built-in fans, air entry at front, air exit at rear
Dimensions		
Desktop model	incl. fans, handles and feet; W × H × D	430 mm × 196 mm × 580 mm (16.93 in × 7.72 in × 22.83 in)
	for rackmounting	19" 1/1, 4 HU
Rack models (W × H × D)	R&S®BBA150-A700/-BC1000/-D400/-E400	19" × 12 HU × 800 mm (31.5 in)
	R&S®BBA150-D800	19" × 20 HU × 800 mm (31.5 in)
	R&S®BBA150-A1300/-BC1250/-BC1500/-BC2000	19" × 20 HU × 1000 mm (39.4 in)
	R&S®BBA150-A2500	19" × 35 HU × 800 mm (31.5 in)
	R&S®BBA150-BC3000	19" × 35 HU × 1000 mm (39.4 in)

Specifications in brief		
Environmental conditions		
Temperature loading	operating temperature range	0 °C to +40 °C
	storage temperature range	–20 °C to +70 °C
Damp heat		max. +40 °C at 95 % rel. humidity, without condensation
Altitude	operating altitude	up to 2000 m
	storage altitude	up to 4600 m
Protection		
Load VSWR		infinite
Interlock		1 device interlock, 1 configurable interlock
Input protection against bias voltage	optional	DC block level ≤ 50 V DC
Transient voltage compatibility		category II, in line with IEC 60364-4-443
Short-circuit breaking capacity		automatic all-pole 20 A circuit breaker
Thermal overload		shutdown in case of thermal overload

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.
R&S®BBA150 single-band power amplifiers		
Frequency band from 9 kHz to 250 MHz		
125 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A125
160 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A160
200 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A200
400 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A400
700 W, air-cooled, 12 HU rack model	R&S®BBA150	BBA150-A700
1300 W, air-cooled, 20 HU rack model	R&S®BBA150	BBA150-A1300
2500 W, air-cooled, 35 HU rack model	R&S®BBA150	BBA150-A2500
Frequency band from 4 kHz to 400 MHz		
75 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-AB75
125 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-AB125
160 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-AB160
200 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-AB200
350 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-AB350
600 W, air-cooled, 12 HU rack model	R&S®BBA150	BBA150-AB600
Frequency band from 80 MHz to 1.0 GHz		
70 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC70
125 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC125
160 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC160
250 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC250
500 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC500
1000 W, air-cooled, 12 HU rack model	R&S®BBA150	BBA150-BC1000
1250 W, air-cooled, 20 HU rack model	R&S®BBA150	BBA150-BC1250
1500 W, air-cooled, 20 HU rack model	R&S®BBA150	BBA150-BC1500
2000 W, air-cooled, 20 HU rack model	R&S®BBA150	BBA150-BC2000
3000 W, air-cooled, 35 HU rack model	R&S®BBA150	BBA150-BC3000
Frequency band from 0.69 GHz to 3.2 GHz		
30 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D30
60 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D60
110 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D110
200 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D200
400 W, air-cooled, 12 HU rack model	R&S®BBA150	BBA150-D400
800 W, air-cooled, 20 HU rack model	R&S®BBA150	BBA150-D800
Frequency band from 2.5 GHz to 6.0 GHz		
15 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-E15
30 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-E30
60 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-E60
100 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-E100
200 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-E200
400 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-E400
Accessories supplied: power cord, user manual on CD.		

Designation	Type	Configuration No.
R&S®BBA150 twin-band power amplifiers [1)]		
Frequency bands 2 × from 9 kHz to 250 MHz		
75 W/75 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A75A75
125 W/125 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A125A125
200 W/200 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A200A200
Frequency bands 2 × from 80 MHz to 1 GHz		
160 W/160 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC160BC160
250 W/250 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC250BC250
Frequency bands 2 × from 0.69 GHz to 3.2 GHz		
30 W/30 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D30D30
60 W/60 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D60D60
110 W/110 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D110D110
Frequency bands 2 × from 2.5 GHz to 6.0 GHz		
30 W/30 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-E30E30
60 W/60 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-E60E60
100 W/100 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-E100E100
Accessories supplied: power cord, user manual on CD.		
R&S®BBA150 dual-band power amplifiers [1)]		
Frequency bands from 9 kHz to 250 MHz and from 80 MHz to 1 GHz		
125 W/70 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A125BC70
125 W/125 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A125BC125
125 W/250 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A125BC250
160 W/125 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A160BC125
160 W/160 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A160BC160
200 W/70 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A200BC70
200 W/125 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A200BC125
200 W/250 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A200BC250
400 W/125 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A400BC125
400 W/70 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-A400BC70
Frequency bands from 80 MHz to 1.0 GHz and from 0.69 GHz to 3.2 GHz		
125 W/30 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC125D30
125 W/60 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC125D60
125 W/110 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC125D110
250 W/30 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC250D30
250 W/60 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC250D60
250 W/110 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-BC250D110
Frequency bands from 0.69 GHz to 3.2 GHz and from 2.5 GHz to 6.0 GHz		
30 W/15 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D30E15
30 W/30 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D30E30
60 W/15 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D60E15
60 W/30 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D60E30
60 W/60 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D60E60
110 W/30 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D110E30
110 W/60 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D110E60
110 W/100 W, air-cooled, 4 HU desktop model	R&S®BBA150	BBA150-D110E100
Accessories supplied: power cord, user manual on CD.		

Designation	Type	Configuration No.
Options		
GPIB Remote Control, external converter	R&S®BBA-B101	5355.8250.02
GPIB Remote Control, for racks up to 30 HU	R&S®BBA-B101	5355.8250.03
GPIB Remote Control, for racks higher than 30 HU	R&S®BBA-B101	5355.8250.04
RF Input Switch (1:2 or 2:1, N)	R&S®BBA-B110	5355.8866.02 [2]
RF Input Switch (1:6, N)	R&S®BBA-B116	5355.8950.02
RF Output Switch (2:1 or 1:2, N)	R&S®BBA-B120	5355.8795.02 [2]
RF Output Switch (2:2, 7/16)	R&S®BBA-B121	5355.8895.02 [2]
RF Output Switch (2:2, 7/8" EIA)	R&S®BBA-B122	5355.8989.02
RF Output Switch (2:2, 1 5/8" EIA)	R&S®BBA-B123	5355.8943.02
RF Output Switch (6:1, N)	R&S®BBA-B126	5355.8995.02
Fast Amplifier Mute, only for applications above 3 MHz	R&S®BBA-B130	5355.8114.02
DC Block Input Protection (N)	R&S®BBA-B132	5353.9236.03
RF Forward/RF Reflected Sample Ports (N front)	R&S®BBA-B140	5355.8837.02
RF Forward/RF Reflected Sample Ports (N rear)	R&S®BBA-B140	5355.8837.03
Detected Forward/Detected Reflected Sample Ports (N front)	R&S®BBA-B141	5355.8850.02
Detected Forward/Detected Reflected Sample Ports (N rear)	R&S®BBA-B141	5355.8850.03
Sample Port Switch (dual-port, N front)	R&S®BBA-B142	5355.8872.02
Sample Port Switch (dual-port, N rear)	R&S®BBA-B142	5355.8872.03
Transparent I/O	R&S®BBA-B160	5355.8889.02

[1] Amplifier systems with two or more frequency bands are available in many combinations. The table shows only a selection of the multiband power amplifiers.
[2] The last two digits of the order number depend on the system configuration.