

# R&S® BBL200 BROADBAND AMPLIFIER

## Specifications

9 kHz to 225 MHz



Specifications  
Version 05.00

**ROHDE & SCHWARZ**

Make ideas real



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Rohde & Schwarz equipment is designed for reliable operation up to an altitude of 2000 m above sea level, and for transport up to an altitude of 4600 m above sea level.

All specified parameters are valid for an ambient temperature of +25 °C, input impedance of 50 Ω and output impedance of 50 Ω. Data without tolerance limits is not binding.

RoHS Europe, Directive 2011/65/EU: equipment category 9, fulfilled without any exceptions.

WEEE Europe, Directive 2002/96/EC:

No disposing with unsorted municipal waste; no return with collection of waste electrical and electronic equipment from private households. Separate collection necessary. Ask Rohde & Schwarz representatives about recovery.

# Definitions

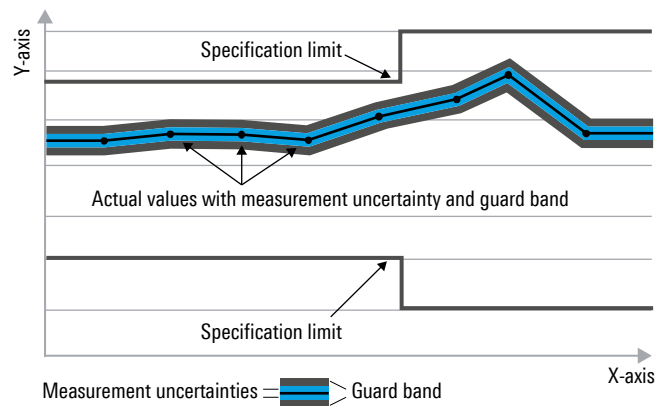
## General

Product data applies under the following conditions:

- Three hours of storage at ambient temperature followed by 30 minutes of warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

## Specifications with limits

Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as  $<$ ,  $\leq$ ,  $>$ ,  $\geq$ ,  $\pm$ , or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



## Specifications without limits

Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

## Typical data (typ.)

Characterizes product performance by means of representative information for the given parameter. When marked with  $<$ ,  $>$  or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

## Nominal values (nom.)

Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

## Measured values (meas.)

Characterize expected product performance by means of measurement results gained from individual samples.

## Uncertainties

Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

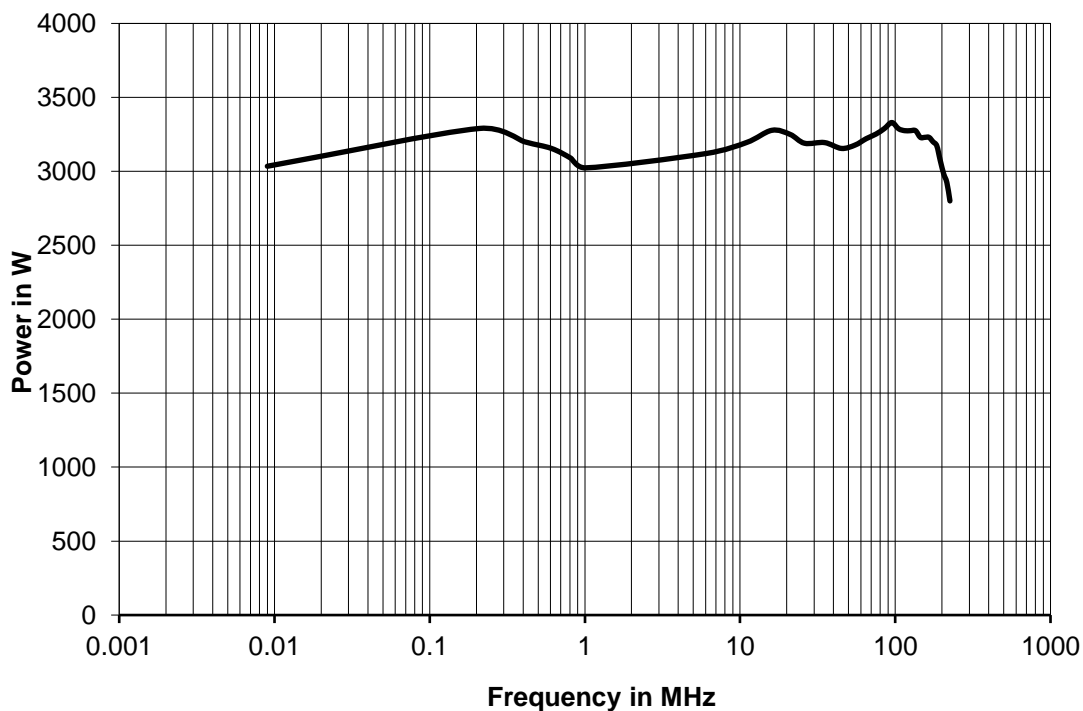
Device settings and GUI parameters are indicated as follows: "parameter: value".

Typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

# Frequency band from 9 kHz to 225 MHz

Power class: 3000 W

Frequency response at 1 dB compression



## RF specifications

Main parameters		
Frequency range		9 kHz to 225 MHz instantaneously
Nominal output load		50 $\Omega$
Nominal output power		3000 W (64.8 dBm)
Output power	9 kHz to 20 MHz	min. 3000 W (64.8 dBm)
	20 MHz to 110 MHz	min. 3400 W (65.3 dBm)
	110 MHz to 225 MHz	gradual reduction to min. 2800 W (64.5 dBm) at 225 MHz
Power output at 1 dB compression	9 kHz to 110 MHz	min. 3000 W (64.8 dBm)
	110 MHz to 225 MHz	gradual reduction to min. 2800 W (64.5 dBm) at 225 MHz
Nominal power gain		68.2 dB
Gain flatness		$\pm 3.0$ dB
Gain adjustment range		> 15 dB
Harmonics	9 kHz to 110 MHz at 3000 W	< -20 dBc
	110 MHz to 225 MHz at 2800 W	< -20 dBc
Third-order intermodulation (IM3)	2-tone at 58.5 dBm/tone, above 1 MHz, test frequencies 100 kHz apart	nom. < -20 dBc
Spurious	carrier offset > 100 kHz, from 1 MHz	nom. -80 dBc, max. -70 dBc
Noise figure	at maximum gain	
	5 MHz to 50 MHz	< 16.0 dB (nom.)
	50 MHz to 225 MHz	< 9.0 dB (nom.)

<b>Input</b>		
Nominal input impedance		50 $\Omega$
Input level for nominal output power		nom. -3.4 dBm
Input VSWR	at 50 $\Omega$	max. 2:1
Maximum input level	RF	+5 dBm
	DC	0 V

<b>Output</b>		
Nominal output impedance		50 $\Omega$
Output mismatch tolerance	VSWR < 6:1	without foldback
	VSWR > 6:1	with gradual foldback to approx. 50 % of nominal output power, depending on load impedance
Output mismatch protection, VSWR		100 %, without damage

<b>RF sample and detected RF sample signals</b>		
RF sample signal coupling factor	sample ports for forward and reflected RF	approx. 70 dB, see test report for details
Detected RF sample signal level	sample ports for detected forward and reflected RF (alternatively)	up to 3.0 V DC, see test report for details

## Mechanical specifications

<b>Amplifier system</b>		
Dimensions	rack setup, W x H x D, incl. handles, stands and crane lugs	600 mm x 1570 mm x 1100 mm (23.62 in x 61.81 in x 43.31 in)
Weight		approx. 280 kg (617 lb)

<b>Heat exchanger</b>		
Dimensions	W x H x D, incl. handles and stands	1241 mm x 558 mm x 400 mm (48.86 in x 21.97 in x 15.75 in)
Dry weight		approx. 29 kg (64 lb)

<b>Connectors</b>			
Connecting plate at rack top cover, or alternatively connecting plate at rear panel, bottom	RF input port	N female	
	sample ports for RF or detected RF	N female	
	Ethernet	RJ-45	
	interlock	WAGO X-COM <sup>®</sup> , 7-pin, female	
	amplifier state	WAGO X-COM <sup>®</sup> , 7-pin, female	
	transparent I/O, optional	2 x WAGO X-COM <sup>®</sup> , 7-pin, female	
RF output port	rear panel, bottom	1 5/8" EIA female	
Mains power	rear panel, bottom	5 x 4 mm <sup>2</sup> power supply cable	
		cable diameter at 380 V to 415 V AC	8 mm to 15 mm
		cable diameter at 208 V to 240 V AC	13 mm to 26 mm
Coolant supply	rack top cover, rear panel or bottom	2 x 40 mm cooling hose	

## Electrical specifications

<b>Amplifier system</b>		
Rated operating voltage		380 V to 415 V AC $\pm$ 10 %, three-phase with N, 47 Hz to 63 Hz
		208 V to 240 V AC $\pm$ 10 %, three-phase, 47 Hz to 63 Hz
Rated current	at 230 V per phase	20.5 A
Rated power	RF <sub>cw</sub> = 3000 W (RMS), VSWR = 1	14.2 kVA
Maximum electrical fuse protection		3 x 63 A

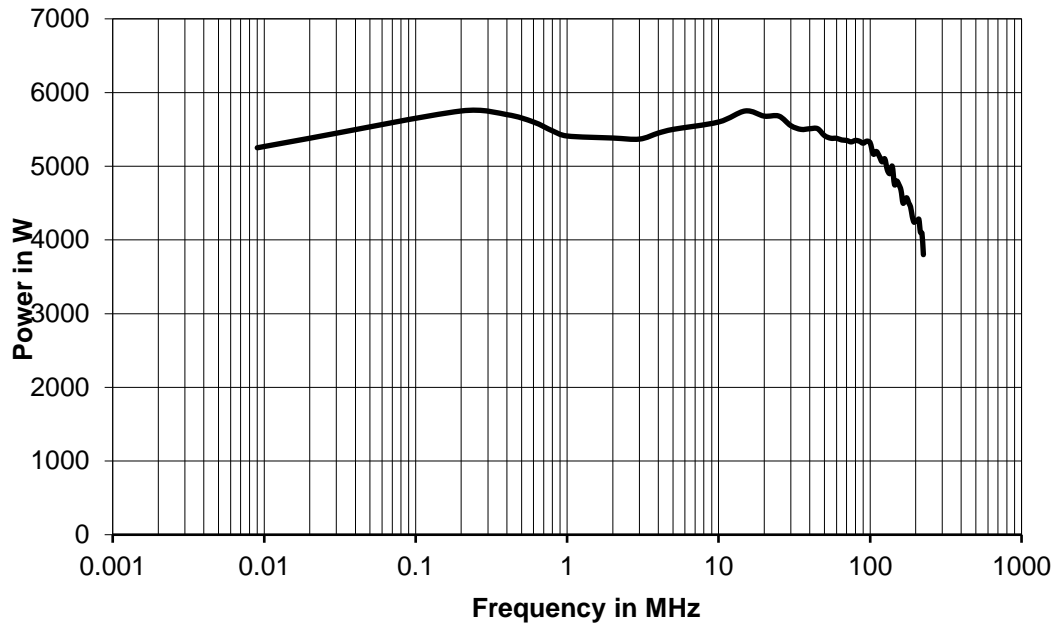
<b>Heat exchanger</b>		
Nominal operating voltage range		230 V AC $\pm$ 10 %, single-phase, 47 Hz to 63 Hz
Current	at 230 V	< 1.5 A
Power consumption		< 350 VA

**Cooling specifications**

<b>Liquid cooling</b>		
Cooling circuit		closed cooling system, automated pressure balancing
Coolant		39 % v/v Antifrogen® N (based on monoethylene glycol, water and anticorrosion additives)
Heat exchanger	capacity	max. 9.5 kW
	air volume flow	6200 m <sup>3</sup> /h
	mounting type	indoor or outdoor, floor installation
Recommended distance between amplifier system and heat exchanger	pipe length	max. 2 × 20 m
	difference in altitude	max. 20 m
Cooling hose	outside diameter	2 × 40 mm
	bending radius	280 mm

## Power class: 5000 W

### Frequency response at 1 dB compression



### RF specifications

Main parameters		
Frequency range		9 kHz to 225 MHz instantaneously
Nominal output load		50 Ω
Nominal output power		5000 W (67.0 dBm)
Output power	9 kHz to 20 MHz	min. 5000 W (67.0 dBm)
	20 MHz to 110 MHz	min. 5500 W (67.4 dBm)
	110 MHz to 225 MHz	gradual reduction to min. 3500 W (65.4 dBm) at 225 MHz
Power output at 1 dB compression	9 kHz to 110 MHz	min. 5000 W (67.0 dBm)
	110 MHz to 225 MHz	gradual reduction to min. 3500 W (65.4 dBm) at 225 MHz
Nominal power gain		70.4 dB
Gain flatness		±3.0 dB
Gain adjustment range		> 15 dB
Harmonics	9 kHz to 110 MHz at 5000 W	< -20 dBc
	110 MHz to 225 MHz at 3500 W	< -20 dBc
Third-order intermodulation (IM3)	2-tone at 59.4 dBm/tone, above 1 MHz, test frequencies 100 kHz apart	nom. < -20 dBc
Spurious	carrier offset > 100 kHz, from 1 MHz	nom. -80 dBc, max. -70 dBc
Noise figure	at maximum gain	
	5 MHz to 50 MHz	< 16.0 dB (nom.)
	50 MHz to 225 MHz	< 9.0 dB (nom.)

Input		
Nominal input impedance		50 Ω
Input level for nominal output power		nom. -3.4 dBm
Input VSWR	at 50 Ω	max. 2:1
Maximum input level	RF	+5 dBm
	DC	0 V

<b>Output</b>		
Nominal output impedance		50 $\Omega$
Output mismatch tolerance	VSWR < 6:1	without foldback
	VSWR > 6:1	with gradual foldback to approx. 50 % of nominal output power, depending on load impedance
Output mismatch protection, VSWR		100 %, without damage

<b>RF sample and detected RF sample signals</b>		
RF sample signal coupling factor	sample ports for forward and reflected RF	approx. 70 dB, see test report for details
Detected RF sample signal level	sample ports for detected forward and reflected RF (alternatively)	up to 3.0 V DC, see test report for details

## Mechanical specifications

<b>Amplifier system</b>		
Dimensions	rack setup, W x H x D, incl. handles, stands and crane lugs	600 mm x 2050 mm x 1100 mm (23.62 in x 80.71 in x 43.31 in)
Weight		approx. 460 kg (1014 lb)

<b>Heat exchanger</b>		
Dimensions	W x H x D, incl. handles and stands	1125 mm x 925 mm x 600 mm (44.29 in x 36.42 in x 23.62 in)
Dry weight		56 kg (123 lb)

<b>Connectors</b>		
Connecting plate at rack top cover, or alternatively connecting plate at rear panel, bottom	RF input port	N female
	sample ports for RF or detected RF	N female
	Ethernet	RJ-45
	interlock	WAGO X-COM <sup>®</sup> , 7-pin, female
	amplifier state	WAGO X-COM <sup>®</sup> , 7-pin, female
	transparent I/O, optional	2 x WAGO X-COM <sup>®</sup> , 7-pin, female
RF output port	rear panel, bottom	1 5/8" EIA female
Mains power	rear panel, bottom	5 x 10 mm <sup>2</sup> power cable supply
	cable diameter at 380 V to 415 V AC	13 mm to 26 mm
	cable diameter at 208 V to 240 V AC	18 mm to 32 mm
Coolant supply	rack top cover, rear panel or bottom	2 x 40 mm cooling hose

## Electrical specifications

<b>Amplifier system</b>		
Rated operating voltage		380 V to 415 V AC $\pm$ 10 % three-phase with N, 47 Hz to 63 Hz
		208 V to 240 V AC $\pm$ 10 % three-phase, 47 Hz to 63 Hz
Rated current	at 230 V per phase	35.0 A
Rated power	RF <sub>cw</sub> = 5000 W (RMS), VSWR = 1	24.0 kVA
Recommended electrical fuse protection		3 x 63 A

<b>Heat exchanger</b>		
Nominal operating voltage range		230 V AC $\pm$ 10 %, single-phase, 47 Hz to 63 Hz
Current	at 230 V	< 3.5 A
Power consumption		< 810 VA

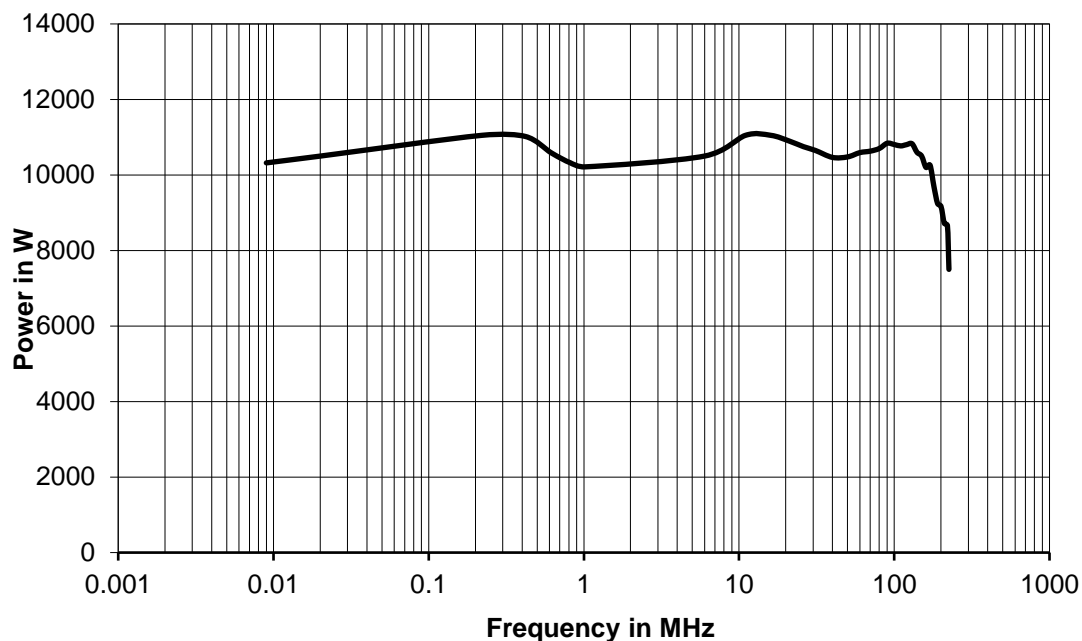


**Cooling specifications**

<b>Liquid cooling</b>		
Cooling circuit		closed cooling system, automated pressure balancing
Coolant		39 % v/v Antifrogen® N (based on monoethylene glycol, water and anticorrosion additives)
Heat exchanger	capacity	max. 15.7 kW
	air volume flow	5145 m <sup>3</sup> /h
	mounting type	indoor or outdoor, floor installation
Recommended distance between amplifier system and heat exchanger	pipe length	max. 2 × 20 m
	difference in altitude	max. 20 m
Cooling hose	outside diameter	2 × 40 mm
	bending radius	280 mm

## Power class: 10000 W

### Frequency response at 1 dB compression



### RF specifications

Main parameters		
Frequency range		9 kHz to 225 MHz instantaneously
Nominal output load		50 $\Omega$
Nominal output power		10000 W (70.0 dBm)
Output power	9 kHz to 20 MHz	min. 10000 W (70.0 dBm)
	20 MHz to 110 MHz	min. 10300 W (70.1 dBm)
	110 MHz to 225 MHz	gradual reduction to min. 8000 W (69.0 dBm) at 225 MHz
Power output at 1 dB compression	9 kHz to 110 MHz	min. 10000 W (70.0 dBm)
	110 MHz to 225 MHz	gradual reduction to min. 7000 W (68.5 dBm) at 225 MHz
Nominal power gain		73.4 dB
Gain flatness		$\pm 3.0$ dB
Gain adjustment range		> 15 dB
Harmonics	9 kHz to 110 MHz at 10000 W	< -20 dBc
	110 MHz to 225 MHz at 8000 W	< -20 dBc
Third-order intermodulation (IM3)	2-tone at 62.5 dBm/tone, above 1 MHz, test frequencies 100 kHz apart	nom. < -20 dBc
Spurious	carrier offset > 100 kHz, from 1 MHz	nom. -80 dBc, max. -70 dBc
Noise figure	at maximum gain	
	5 MHz to 50 MHz	< 16.0 dB (nom.)
	50 MHz to 225 MHz	< 9.0 dB (nom.)

Input		
Nominal input impedance		50 $\Omega$
Input level for nominal output power		nom. -3.4 dBm
Input VSWR	at 50 $\Omega$	max. 2:1
Maximum input level	RF	+5 dBm
	DC	0 V

<b>Output</b>		
Nominal output impedance		50 $\Omega$
Output mismatch tolerance	VSWR < 6:1	without foldback
	VSWR > 6:1	with gradual foldback to approx. 50 % of nominal output power, depending on load impedance
Output mismatch protection, VSWR		100 %, without damage

<b>RF sample and detected RF sample signals</b>		
RF sample signal coupling factor	sample ports for forward and reflected RF	approx. 70 dB, see test report for details
Detected RF sample signal level	sample ports for detected forward and reflected RF (alternatively)	up to 3.0 V DC, see test report for details

## Mechanical specifications

<b>Amplifier system</b>		
Dimensions	rack setup, W x H x D, incl. handles, stands and crane lugs	1200 mm x 2050 mm x 1100 mm (47.24 in x 80.71 in x 43.31 in)
Weight		approx. 870 kg (1915 lb)

<b>Heat exchanger</b>		
Dimensions	W x H x D, incl. handles and stands	2400 mm x 1150 mm x 600 mm (9445.88 in x 452.76 in x 236.22 in)
Dry weight		approx. 238 kg (525 lb)

<b>Connectors</b>		
Connecting plate at rack top cover, or alternatively connecting plate at rear panel, bottom	RF input port	N female
	sample ports for RF or detected RF	N female
	Ethernet	RJ-45
	interlock	WAGO X-COM <sup>®</sup> , 7-pin, female
	amplifier state	WAGO X-COM <sup>®</sup> , 7-pin, female
	transparent I/O, optional	2 x WAGO X-COM <sup>®</sup> , 7-pin, female
RF output port	rear panel, bottom	1 5/8" EIA female
Mains power	rear panel, bottom	5 x 16 mm <sup>2</sup> power supply cable
	cable diameter	32 mm
Coolant supply	rack top cover, rear panel or bottom	2 x 51 mm cooling hose

## Electrical specifications

<b>Amplifier system</b>		
Rated operating voltage		380 V to 415 V AC $\pm$ 10 %, three-phase with N, 47 Hz to 63 Hz
Rated current	at 230 V per phase	72 A
Rated power	RF <sub>cw</sub> = 10000 W (RMS), VSWR = 1	50 kVA
Recommended electrical fuse protection		3 x 80 A

<b>Heat exchanger</b>		
Nominal operating voltage range		230 V AC $\pm$ 10 %, single-phase, 47 Hz to 63 Hz
Current	at 230 V	< 13 A
Power consumption		< 3000 VA

**Cooling specifications**

<b>Liquid cooling</b>		
Cooling circuit		closed cooling system, automated pressure balancing
Coolant		39 % v/v Antifrogen® N (based on monoethylene glycol, water and anticorrosion additives)
Heat exchanger	capacity	max. 41 kW
	air volume flow	20100 m <sup>3</sup> /h
	mounting type	indoor or outdoor, floor installation
Recommended distance between amplifier system and heat exchanger	pipe length	max. 2 × 20 m
	difference in altitude	max. 20 m
Cooling hose	outside diameter	2 × 51 mm
	bending radius	280 mm

## General data

### Modulation specifications

Modulation capability	AM, FM, $\phi$ M or PM
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### Control specifications

<b>Remote control</b>		
Ethernet		RJ-45, 10/100 Mbit/s, autonegotiation, half/full duplex

<b>Local HM</b>		
Local display		200 x 48 pixel, monochrome
Manual controls	resting pushbutton	mains switch
	operation pushbuttons	<ul style="list-style-type: none"> <li>• system standby/on</li> <li>• RF standby/operate</li> <li>• local/remote</li> </ul>
	menu pushbuttons	<ul style="list-style-type: none"> <li>• arrow up, down, left, right</li> <li>• ok</li> <li>• back</li> </ul>
LED status information		<ul style="list-style-type: none"> <li>• system standby/on</li> <li>• RF standby/operate</li> <li>• mute ready</li> <li>• interlock</li> <li>• error</li> <li>• local/remote</li> </ul>

<b>Web GUI</b>		
Remote web GUI	via Ethernet	RJ-45, 10/100 Mbit/s, autonegotiation, half/full duplex

### Environmental specifications

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
Calibration interval		no calibration needed
Electromagnetic compatibility	immunity	in line with EN 61326-1, public and industrial areas
	electromagnetic fields	≤ 10 V/m, in line with IEC 61000-4-3
	surge test: line to ground	≤ 2 kV, in line with IEC 61000-4-5
	surge test: Ethernet to ground	≤ 2 kV, in line with IEC 61000-4-5
	surge test: line to line	≤ 1 kV, in line with IEC 61000-4-5
	bursts	≤ 2 kV, in line with IEC 61000-4-4
Electromagnetic emissions	overall	in line with EN 55011 (CISPR 11), industrial area, ISM group 1 or 2 and FCC 047 CFR part 18, nonconsumer equipment
	conducted emissions	in line with EN 55011, class A
	radiated emissions	equipment for use in shielded areas only, normative limits of EN 55011 group 1/2 class A or FCC 047 CFR part 18 exceeded up to 60 dB
Electromagnetic field strength	all-around the enclosure	in line with the limits of rec 1999/519/EC, 26. BImSchV, BGV B11 exposure limit 2 (protection of health and safety of workers, consumers and the general public)
Electrical safety		in line with EN 61010-1:2010, IEC 61010-1:2011 + Corr. 2011 (third ed.)

## Protection

<b>RF</b>		
Load VSWR		unlimited
Interlock		1 device interlock, 1 configurable interlock
Input protection against bias voltage	optional	DC block level $\leq 50$ V DC

<b>Power supply</b>		
Transient voltage compatibility		category II, in line with IEC 60364-4-443
Switching capacity of internal fuses		< 10 kA

<b>Miscellaneous</b>		
Thermal overload		shutdown at thermal overload

<b>Liquid cooling</b>		
Pressure overload		pressure relief valve, 5 bar
Module exchange		self-shutting valves

## Ordering information

We recommend that you ask your local Rohde & Schwarz expert to find the solution that is optimally suited to your needs.

### R&S®BBL200 single-band power amplifiers

#### Frequency band from 9 kHz to 225 MHz

Designation	Type	Configuration No.
3000 W, liquid-cooled, 31 HU rack model	R&S®BBL200	BBL200-A3000
5000 W, liquid-cooled, 42 HU rack model	R&S®BBL200	BBL200-A5000
10000 W, liquid-cooled, 2 x 42 HU rack model	R&S®BBL200	BBL200-A10000

Accessories supplied: rack power cord, user manual (printed and on CD), test report, indoor heat exchanger, 2 x 20 m cooling hose and filling pump.

#### Options

Designation	Type	Order No.
GPIO remote control	R&S®BBA-B101	5355.8250.05
Fast amplifier mute for applications above 3 MHz	R&S®BBL-B130	5356.9914.02
DC block input protection (N)	R&S®BBA-B132	5353.9236.03
Sample ports for forward and reflected RF (N), interface rear bottom for 3000 W and 5000 W model	R&S®BBL-B140	5356.9937.02
Sample ports for forward and reflected RF (N), interface rear bottom for 10000 W model, interface rack top cover for all models	R&S®BBL-B140	5356.9937.03
Sample ports for detected forward and reflected RF (N)	R&S®BBL-B141	5356.9908.02
Transparent I/O	R&S®BBL-B160	5356.9920.02
Rack wheels	R&S®ZR1-RW01	5354.4309.02

## Service

#### Service level agreements

Rohde & Schwarz offers maintenance and support services to maximize and protect the investment of customers' Rohde & Schwarz products. Details are given in the "Service Levels Description for Rohde & Schwarz Broadband Amplifiers" document (PD 3607.6467.92).

#### Calibration information

An optional calibration can be ordered for the R&S®BBL200. Note that the simple acceptance rule is selected for the declaration of conformity (cf. ILAC-G8:09/2019, section 4.2.1).

#### System upgrades

Upgrades in frequency band and/or RF output power are available on request.

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

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

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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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